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COLON STUDIES
IV. THE ROENTGEN DIAGNOSIS OF COLITIS* (THE IRRITABLE COLON)

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IN some recent articles, it was pointed out that simple (non-ulcerative) colitis (colonic irritability) is a common disorder of digestion; and that it is susceptible of very precise roentgen demonstration. It is the object of the present paper to elaborate on the theme of roentgen diagnosis, and to present in illustration a fairly large number of typical films obtained from cases actually observed in private and hospital practice. This is done with the hope of still further popularizing the general idea of thorough roentgen studies on all chronic dyspeptics, so that the early and simple forms of digestive disorders may be more widely understood and effectively handled.

The earliest work on the roentgen diagnosis of colitis by Stierlin (1911, 1912) and by Kienböck (1913) dealt almost exclusively with the advanced organic varieties,such as the tuberculous and the ulcerative. These severe forms are rare, however, and will receive only passing attention in this paper.

The first account of the common functional types of this disorder appeared under the title of "chronic catarrhal and mucous colitis" in the classic monograph of Schwarz in 1914. Since then, relatively little attention has been given to the roentgen diagnosis of simple colitis. Nevertheless, noteworthy studies have been made by Case (1914), Jones (1918), Schlesinger (1922), and Mills (1924). Important as these contributions are, they have unfortunately failed as yet to attract to the subject the attention that its importance really merits.

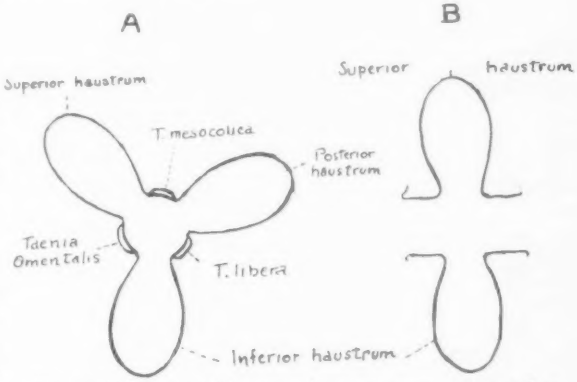

FIG. 1. Diagram of haustra in transverse colon (after Thaysen, modified). A. Transverse section. B. Front view (anteroposterior) as seen in usual roentgenogram. Synonyms: Taenia libera or posterior or postero-inferior taenia; taenia omentalis or anterior taenia; taenia mesocolica or postero-medial taenia.

Roentgenologically, the diagnosis of colitis can be made either after the ingestion of a barium meal or after the injection of a barium enema. The former method is

*This is the fourth of a series of articles by the same author: A clinical study of some common anatomical abnormalities of the colon. I. The redundant colon. AM. J. ROENTGENOL. & RAD. THERAP., Nov., 1924, xii, 414; II. The low cecum. *Ibid.*, Sept., 1925, xiv, 207; III. The clinical significance of ileal stasis: its association with colitis. *Ibid.*, July, 1926, xvi, 1.

Fig. 2. Normal colon showing well-balanced haustra in transverse portion. Film twenty-four hours after barium meal.

Fig. 3. Normal colon, completely filled, showing haustra from cecum to rectum. Film twenty-four hours after barium meal.

Fig. 4. Simple colitis. Film nine hours after barium meal. Note: Hypermotility, with early packing of barium in rectum; "streaking" through transverse and descending colon; ileal stasis.

Clinical: Widow, aged forty. Five years, "nervousness;" two months, gas distress (belching, flatulence) and epigastric pressure; three stools daily.

Fig. 5. Simple colitis. Film twenty-four hours after barium meal; one stool. Note a typical haustra and the resulting distortion of the fecal column.

Clinical: Woman, age forty-eight. Chronic constipation; fifteen years, attack of "nervous indigestion;" one month, epigastric pains and inability to pass gas by rectum.

by far the more useful for the demonstration of the early simple and mild cases.

DIAGNOSIS BY BARIUM MEAL

A. *From Changes in Colonic Motor Function.* It will be recalled that the filling and emptying of the normal colon take place according to a definite time-table. When the upper alimentary tract transport is normal, the cecum begins to fill four hours after the standard opaque barium meal. At six hours, the head of the barium column reaches the region of the hepatic flexure; the tail is still in the ileum. At nine hours, the head reaches the splenic flexure, and the tail has cleared the terminal small intestine. At twenty-four hours, the bowels have moved once, and the left sided shift has occurred,—that is, the barium has cleared the proximal colon in whole or in part, and has become distributed throughout the distal colon. By forty-eight hours, the bowels have moved twice, and the colon is clear except for traces of the barium.

Any departure from the above schedule is abnormal. If the change is in the direction of stasis, a diagnosis of some variety of constipation is in order. If, on the other hand, the colonic transit is hastened, there exists a state of colonic irritability which is the essential motor expression of colitis. Colitis may therefore be diagnosed, or, at least suspected, from the following roentgen findings:

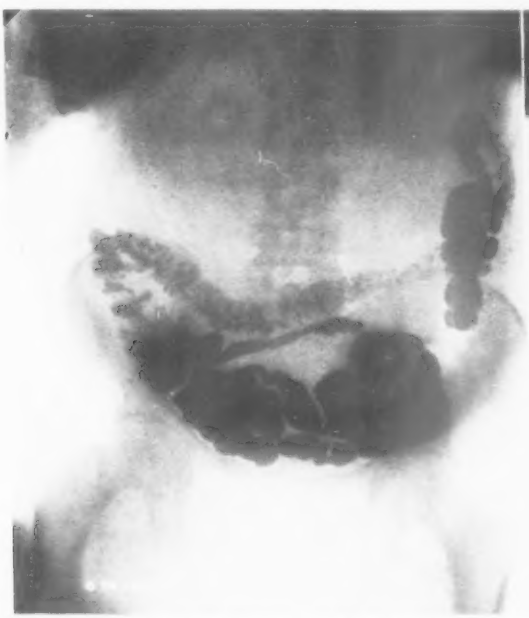

Fig. 6. Simple colitis, secondary to probable carcinoma of head of pancreas. Film 6¼ hours after barium meal. Note: Hypermotility, with head of barium column in descending colon; "feathering" through transverse colon; appearance suggestive of mass peristalsis.
Clinical: Woman, aged sixty. One month, constipation, intense backache, deep jaundice; large hard liver, cachexia.

Fig. 7. Simple colitis. Film twenty-four hours after barium meal. Note: Loss of haustration distal to hepatic flexure; scattered filling of transverse colon; "mottled band" filling of descending and iliac colon.
Clinical: Man, aged thirty-seven. Four months, pain and soreness in lower abdomen, marked gas distress, morning vomiting; daily stool with cathartic once weekly.

1. At the "six-hour observation," the head of the barium column is beyond the splenic flexure (see Figs. 11 and 15).

2. At the "nine-hour observation," the head of the barium column is in the colon or rectum with or without the passage of a stool containing barium (see Figs. 4, 8, 12, and 16).

3. At the "twenty-four observation," the colon is empty.

Furthermore, as shown in the third paper

of this series,[9] stasis in the terminal ileum is a strikingly constant finding in colitis, occurring in about three-quarters of the cases reported. This retention is apparently due to a spasm of the ileocecal sphincter; and the phenomenon has been interpreted as a functional defense reaction for the protection of the irritated colon. Ileal stasis may be diagnosed under the following conditions, each of which is, in turn, equally suggestive, though, of course, not necessarily pathognomonic, of colitis.

4. At the "six-hour observation," no barium has passed the ileocecal junction (relatively rare) (see Fig. 13).

5. At the "nine-hour observation," barium is still present in the terminal ileum (see Figs. 4, 12, 14, and 16).

As additional evidence that ileal stasis is causally related to colitis, there were published in the article just mentioned, two films, taken three weeks apart in the same individual showing the disappearance of the small intestinal stasis concomitantly with the diminution in colonic irritability.

B. *From Changes in Colonic Form.* In addition to the abnormalities of function just described, colitis gives rise to certain interesting changes in the appearance of the colon as revealed by a study of the haustrations. It is the colonic haustra (Latin *baustrum*, a bucket) which are responsible for the characteristic sacculated appearance of the large intestine. These

Fig. 8. Spastic colitis. Film nine hours after barium meal. Note: Hypermotility, with head of barium column in rectum; irregular, deep-cutting haustrations of transverse colon; increasing spasticity of entire distal colon, with breaking up of fecal column; gas in distal colon.
Clinical: Woman, aged sixty-six. Five years, pains in epigastrium and lower abdomen, gas distress; bowels regular; diverticulosis of colon; probable gall-bladder disease.

Fig. 9. Spastic colitis. Film twenty-four hours after barium meal; no stool. Note: Increasing spasticity of transverse colon; loss of haustration in descending and iliac colon; gas in distal colon.
Clinical: Man, aged thirty-five. Chronic constipation and cathartic habit; for eight months attacks of sharp substernal pain, belching, distention, and flatulence.

haustra are arranged in three parallel rows separated by the three bands of longitudinal muscular fibers known as taeniae (see Fig. 1). According to the usual descriptions of the anatomists, the haustra arise because the taeniae are too short for the colon, and cause the walls of the latter to pucker transversely. If the taeniae are cut, it is pointed out, the haustra disappear, and the colon wall becomes smooth like that of the small intestine. However, recent roentgen studies show that this

explanation is probably inadequate. The careful work of Thaysen, for example, indicates that the haustra are due to the active tonic contractions of individual rings of circular fibers. Furthermore, it has again been shown by Lineback, what was originally described by Lowitz, that the circular fibers actually decussate with the taeniae, and that the latter may act as strong fixed longitudinal cables, upon which the circular fibers are attached, and against which they pull to produce the typical cleft configuration of the colon. Finally, it should be pointed out that the regular arrangement of the haustra found in the living subject, disappears to a great extent in death and even during profound anesthesia.

It thus follows that the phenomenon of haustration is not merely a matter of anatomical configuration, fixed in death as in life, but that it represents an exceedingly complicated and exquisitely balanced function of the living colon. It is likewise easy to see how all sorts of nervous influences which may upset the normal tone of the bowel can produce significant and characteristic changes in the appearance of the colonic haustra.

As seen in the usual roentgenogram, only two of the three rows of haustrations are visualized (see Figs. 1 and 2). The posterior row is completely hidden by the upper row and the central axis of the colon. When normal, the haustrations are evenly balanced and spaced,—that is, the lumen is central, and the sacculations on either side are approximately equal in size and symmetry (see Figs. 2 and 3). Such normal haustrations are said to be isomorphic. Moreover, the depth of the interhaustral clefts may be taken to indicate the degree of colon tone or spasticity. Ordinarily, the penetration is for about one-half, or perhaps two-thirds, the diameter of the colon.

In colitis, on the other hand, the haustrations undergo very striking alterations from the normal. In those forms of the disorder characterized primarily by *hypermotility*, there is often a marked irregularity in the size, shape, balance, and spacing of the sacculations (see Figs. 8, 9, 11, 12, 15, and 16). In other instances, we note a more or less complete loss of the haustra, producing a ragged, twisted, or distorted appearance of the fecal column (Fig. 5). Where a large mass of watery feces passes rapidly through a long stretch of bowel, the trail thus produced is represented by either a thin streak (Figs. 4, 11, and 12) or a broader mottled band (Figs. 6, 7, and 11). The latter appearance is sometimes called "feathering." This phenomenon is undoubtedly closely related to the mass peristalsis of Holzknecht, except that instead of occurring three to four times a day, and only after meals, as in the healthy subject, this mass transport as seen in colitis takes place much more frequently, more powerfully, indeed often painfully, and is quite independent of the stimulus of normal food ingestion.

FIG. 10. Spastic colitis. Film nine hours after barium meal. Note: Increased and irregular spacing of haustra resulting in "beaded" or "rosary" colon. Clinical: Woman, aged sixty-seven. Chronic constipation and cathartic habit; for two years attacks of nausea, bad taste, light stools; no jaundice, colic, or gas distress.

A still further development of this localized or zonal hypermotility is the production of filling defects, or the widespread breaking up of the fecal column. When this happens in the early stages of colon filling (during the first nine hours), the condition

is very characteristic indeed of colon irritation (see Figs. 6, 11, and 12). Should the defective filling involve only the proximal large intestine, tuberculous colitis may be suspected. This constitutes the well-known, though hardly specific, Stierlin phenomenon (see Figs. 14, 15, and 16).

Contrasted with the form in which hypermotility (diarrhea) is the outstanding feature, we not infrequently meet with colonic irritability in which *spasticity* is the chief manifestation. This is the so-called dyskinetic or spastic colitis in which constipation, or constipation punctuated with outbursts of diarrhea, is the classic clinical expression. This variety has been studied by Jones of the Mayo Clinic. A characteristic appearance is that depicted in Figure 9, where the colon becomes more and more spastic in its distal portion, the haustra progressively deeper, with corresponding diminution in size and ultimate complete failure of the haustrations. Figure 8 gives a similar impression. In still other cases of this general class, there is a peculiar irregularity in the spacing of the haustra, lending a striking beaded or pulled-out appearance to portions of the colon (see Fig. 10). One is strongly tempted to regard this as an expression of irregularity in the conduction system of the colon; and to draw a parallel between this appearance of the bowel, and the condition of the pulse when extra-systolic impulses are thrown into the regular transmission of the heart beat.

Fig. 11. Ulcerative colitis. Film six hours after barium meal. Note: Hypermotility, with head of barium column in rectum; "feathering" through transverse colon; "streaking" through descending colon; gas in iliac colon; isolated, unhaustrated barium masses in distal colon.
Clinical: Woman, aged twenty-four. Four attacks in eight years of bloody diarrhea with fever, the symptoms lasting each time from six weeks to eight months.

Fig. 12. Ulcerative colitis. Film nine hours after barium meal. Note: Hypermotility, with head of barium meal in rectum; loss of haustration, with "streaking" through transverse colon (B); irregular haustrations in distal colon; ileal stasis (arrows).
Clinical: Man, aged thirty-nine. Fifteen years ago, tropical dysentery (type unknown) for five weeks. For seven months, diarrhea, at first ten, later three to four stools daily, with blood, pus, mucus; no amebae in smears.

Finally, two more findings may be mentioned as diagnostic of colitis by the barium meal method of study. The first is the increased gas content of the large intestine (see Figs. 8, 11, 13, 14, 15, and 16). The second is the presence of flakes or streaks of barium, which may occasionally assume a characteristic stringy or ropy appearance. These have been shown by Case (who administered a cleansing enema,

and examined the return to prove the point) to be due to the presence of barium in the strings or clumps of mucus. Such barium flecks are perhaps best seen in gas-filled areas, particularly in the splenic flexure and descending colon (see Fig. 15).

DIAGNOSIS BY BARIUM ENEMA

In the early stages and simpler forms of colitis, the barium enema may fail entirely to reveal the presence of the condition. For this reason, too much reliance on enema evidence is unwarranted; and the employment of this procedure as the sole method of roentgen diagnosis of purely functional colon disorders is to be condemned. We believe, in short, that whereas the enema can be used to good advantage for the demonstration of organic lesions, it is possibly too artificial and unnatural a method for the diagnosis of simple colitis. In the more advanced forms of the disease, however, the enema gives valuable, though perhaps only corroborative, information.

When this method is employed, the following precautions are recommended:

1. Avoid irritating the bowel in the attempt to empty it prior to examination. Personally, I have followed Case in renouncing castor oil catharsis in favor of two or three successive enemas of physiologic salt solution, two hours before the barium is introduced. "Do not put anything into the rectum that you would not put into your eye" is a good rule in such cases.
2. The opaque enema itself should be absolutely non-irritating as to composition, temperature, and pressure during the administration. We use one glass of barium sulphate and three-quarters glass of kaolin thoroughly stirred in one and one-half quarts of water at 110° F. It should be an invariable rule to stop the flow as soon as the patient complains of the slightest degree of pain; and to resume the procedure only when the cramp has entirely subsided. In many of the more irritable cases, the enema can be introduced only very gradually by alternately pinching and releasing the tubing. The flow is permanently discontinued as soon as the cecum is reached,

Fig. 13. Probable tuberculous colitis. Film six hours after barium meal. Note: Failure of cecum to fill; gas in colon.
Clinical: Man, aged thirty-six. Seven years ago, pleurisy; two years, frank pulmonary tuberculosis; two months, attacks of epigastric pain, abdominal distention and flatulence, constipation; exitus in seven months.

Fig. 14. Probable tuberculous colitis. Film nine hours after barium meal. Note: Filling defect of proximal colon (arrow); ileal stasis. Typical Stierlin phenomenon. Montefiore Hospital case.

Fig. 15. Probable tuberculous colitis. Film six hours after barium meal. Note: Marked hypermotility; widespread loss of haustrations with mottling throughout; defective filling of proximal colon; ballooning of splenic flexure with gas; barium flakes and strands in splenic flexure.

Clinical: Woman, aged thirty-six. One year, pulmonary tuberculosis; eight months, cramps and diarrhea; exitus in six months. Montefiore Hospital case.

Fig. 16. Probable tuberculous colitis. Film nine hours after barium meal. "Stierlin phenomenon." Note: Hypermotility; filling defect of ceco-colon; atypical large haustrations of transverse and distal colon; gas filled splenic flexure; ileal stasis (arrow).

Clinical: Woman, aged twenty-three. Three years, pulmonary tuberculosis; four months, diarrhea; exitus in one month. Montefiore Hospital case.

Fig. 17. Normal colon in slim individual. Opaque enema.

Fig. 18. Normal colon in stocky individual. Opaque enema.

as shown by roentgenoscopic control. The pressure used should not exceed a drop of two to two and one-half feet.

Under these conditions, the normal bowel fills evenly and smoothly, as shown in Figures 17 and 18. The left (expulsive) side of the colon is always more contracted than the right (reservoir) half; but spasms and complete collapse of the walls are absent. The haustrations, though not so deep as after the barium meal, nevertheless remain readily discernible.

Several other findings are of interest. Increased tendency to spasm, characterized by deep-cutting haustrations and narrowing of the bowel lumen is very common. The distal colon is most frequently affected (see Fig. 22); but spasm may occur elsewhere as well (see Fig. 23).

To be contrasted with the appearance just described, is a smoothing of the colon due to complete ironing out of the haustrations—so-called band, tape, or ribbon colon (see Fig. 19). One must be cautious,

FIG. 19. Simple colitis. Opaque enema, 20 ounces. Note smooth, distal colon, with ironed-out haustra from mid-descending colon to rectum. Contrast with Figure 20.

Clinical: Woman, aged thirty-four, luetic, two pelvic operations. Eight years, constipation and cathartic habit, mucus in stools, abdominal pain.

FIG. 20. Redundant and atonic colon. Opaque enema, 80 ounces. Note that loss of haustration in distal colon is here associated with marked dilatation of the bowel.

Clinical: Man, aged twenty-three. Constipation all his life. For one year pains in abdomen.

Perhaps the most common evidence of colonic irritability is the increased speed of passage of the enema, the pain produced on injection, and the decreased amount of fluid necessary to fill the entire bowel to the cecum. Whereas in normal patients the amount required for this purpose is 36 to 40 ounces, in colitis, less than 32 ounces are needed.* In one adult, the figure reached the low limit of 10 ounces.

* A review of the last 200 enemas gives the following average figures: For redundant colons, 46 ounces; for normal colons, 38 ounces; for irritable colons (colitis), 31 ounces.

however, in the interpretation of this phenomenon, as a certain degree of haustral ironing out is normal after enemas. On the other hand, the complete loss of haustration in the extreme forms of redundancy and atony can hardly be a source of confusion, owing to the associated wide dilatation of the bowel lumen (see Fig. 20).

In the severe organic forms, so well described by Carman and his coworkers, marked spasm with areas of permanent narrowing, due to stricture of the intes-

tinal lumen, is the rule. Here, as after the barium meal, increased gas content is commonly encountered (see Fig. 24).

A special form of colonic irritability, demonstrable only after the opaque enema, has been described by Mills. He calls it "fibrillation." A case is illustrated in Figure 21. This condition occurs chiefly in sthenic individuals with relatively short bowels and a tendency to diverticulosis.

Finally, it may be pointed out, as shown by von Bergmann and Lenz, that many of the above findings, produced by *bland* enemata in *irritable* colons, are strikingly comparable to the effects produced on normal colons by soap enemas and other irritants.

Fig. 21. Fibrillation of colon. Opaque enema, 28 ounces. Note numerous small contractions superimposed upon normal haustra.
Clinical: Man, aged thirty-seven, sthenic. Ten years, constipation; six years, cathartic habit; one year, gas pains, attacks of vertigo.

COMMENTS

1. Colitis, in the sense in which the term is here employed, implies simply an abnormal irritability of the colon. This irritability, though fixed in the organic form of infection and ulceration, is more often a purely transient, functional phenomenon as observed in many patients suffering from obscure or patent digestive disorders.

2. Inasmuch as the irritability may be definitely limited to certain portions of the bowel, it does not by any means follow that colitis is synonymous with diarrhea. In other words, there is often a partial, instead of a total colonic hypermotility. It is in just such masked cases, where in fact, constipation is the outstanding symptom, that the roentgen diagnosis is most useful.

Fig. 22. Spastic colitis. Opaque enema, 11 ounces. Note: Marked spasticity of entire distal colon characterized by deep-cutting, irregular haustrations with narrowing of lumen.
Clinical: Woman, aged forty-eight. Many years gas distress, abdominal distention, insufficient flatus, vertigo.

3. Ideally, a thorough roentgen investigation of the colon should include the systematic study of a barium meal from its ingestion by mouth to its complete evacuation from the intestine, followed by an opaque enema. If for any reason, a short cut to diagnosis is necessary, most information on the subject of colitis may be derived from a properly conducted "nine-hour observation." If at this time, the barium has reached the pelvic colon or rectum (with or without a stool in the interval), the haustra are atypical, and there is a residue in the ileum (though this may at

times be absent),—a diagnosis of colitis may be safely ventured. The "ideal" technique for the nine-hour observation has already been outlined in the third paper of this series. Suffice it here to repeat that a final decision as to ileal stasis can only be made at nine hours if the stomach is known to be empty at five hours.

4. In the severe organic colitides, such as the ulcerative, the condition is so evident clinically, that the diagnostic rôle played by the roentgen ray is purely secondary

FIG. 23. Simple colitis in a case of redundant colon. Opaque enema, 45 ounces. Note: Spastic transverse and descending colon and redundant pelvic loop. Such irritability is frequent in elongated bowels. Clinical: Man, aged thirty-five. Three years constipation, enema habit, gas distress, nausea; barium meal shows ileal stasis.

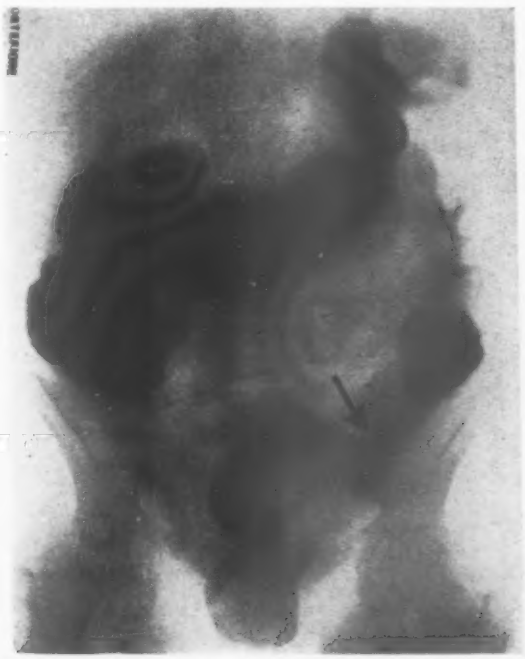

FIG. 24. Ulcerative colitis. Opaque enema. Note: Spasms throughout distal colon; permanent contracture ileo-pelvic colon (arrow); gas in descending colon; dilatation proximal colon (compensatory). Clinical: Woman, aged forty. For twelve years up to eight foul, purulent, unformed stools daily; severe cramps and gas distress; anemia, malnutrition; proctoscopy shows advanced, bleeding, polypoid rectocolitis. Montefiore Hospital case.

or confirmatory. Not so with the simple functional forms of colitis. Here, the real condition is often so obscure, and the differential diagnosis from other abdominal diseases so difficult, that the help afforded by the roentgen ray is most welcome and often most decisive. Indeed, in the field of colitis, it may be said that the roentgen ray helps most where most help is needed.

SUMMARY AND CONCLUSIONS

1. Colitis is readily diagnosed by the roentgen-ray method.

2. The roentgen diagnosis of colitis is based on the recognition of characteristic changes in colonic form and function.

3. For the roentgen diagnosis of colitis, a barium meal is preferable to the barium enema.

4. The roentgen diagnosis of colitis can, in most cases, be readily made by an observation nine hours after the ingestion of a barium meal.

5. The "nine-hour observation" is very simply performed; and may be incorporated with advantage in the routine roentgen examination of the gastrointestinal tract.

6. Although only confirmatory in the organic forms of colitis, the roentgen ray is of primary diagnostic value in the more common and often more baffling functional varieties of the disorder.

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A ROENTGENOLOGICAL SIGN OF MUCOUS COLITIS*

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MUCOUS colitis is a different disease from the inflammatory types of colitis. It is not catarrhal although it is characterized by the discharge of large quantities of mucus. It is not ulcerative although this mucus may at times be streaked with blood. Tubular casts of the bowel may not infrequently be passed per rectum and yet the tenacious mucus separates from the colon without a lesion of the lining membrane. It is located in the colon and yet it is not primarily a disease of the colon but of the nervous system. It is, in fact, a neurosis with a visceral manifestation as the synonym myxoneurosis intestinalis signifies.

This disorder is given the least space in standard works and the most synonyms of any important disease; to wit, mucous colitis, mucous colic, tubular diarrhea, chronic exudative enteritis, chronic mucocolitis, fibrinous diarrhea, pellicular enteritis, pseudomembranous enteritis, membranous enteritis, membranous colitis, membranous enterocolitis, mucomembranous colitis, enteritis membranacea, myxomembranous colitis, myxorrhea coli, myxoneurosis intestinalis. What other disease is so well buried under the verbal débris of several centuries? But this is not all. A prominent authority in a three volume work, "on Diseases of the Rectum, Anus and Colon," 1923, states, "To eliminate confusion relative to the nomenclature of so-called membranous enterocolitis and mucous colic, the author designates these conditions as myxorrhea membranacea and myxorrhea colica." We would suggest that after each of these names the author's name be appended in recognition of an outstanding feat in etymology. This distinguished writer, at a time when verbal ingenuity seemed to have been exhausted, invented not simply one combination but two perfectly new word-complexes to apply to one rather obscure disease. What there is about mucous colitis to stimulate activity in its etymology instead of its pathology is a question for the psychologist. Perhaps the disease will yet have a chance if this verbiage can be swept into the innocuous desuetude originally pro-

*Read at the Twenty-seventh Annual Meeting, American Roentgen Ray Society, Detroit, Mich., May 17–21, 1926.

vided for political rubbish. It would be practically impossible to follow this disease through literature were it not for the saving fact that whatever name an author has invented or prefers he, almost without exception, uses also the term, mucous colitis.

Its importance in clinical and roentgenological practice lies in the fact that it is a cause of abdominal pain. This pain may be mild like a chronic appendicitis or severe like a gallstone colic. Indeed the severer

Fig. 1. Observe the mottled, shreddy, spotted colon with a striking snow-storm effect. Proven at operation to be a polyposis of colon. Shown as a contrast to the string-sign.

types of pain have been called mucus crises, thus recognizing their similarity to the gastric crises of tabes. Unlike tabes, however, which is now a rare disease, mucous colitis is fairly common and has no relation whatever to lues. In frequency, according to our experience, it ranks fifth as a cause of chronic recurring abdominal pain, the first four being in order, dyspepsias, peptic ulcer, chronic appendicitis and gallstones.

If it is true that mucous colitis is as frequent a cause of abdominal pain as thus indicated, then it has suffered a curious and extraordinary neglect at the hands of both the internist and roentgenologist. But it is not a "new disease." Osler, who gives one of the best descriptions, begins with the statement: "This remarkable disease has been recognized for several centuries." He states also that an exhaustive treatise on mucous colitis is to be found in Woodruff's Medical and Surgical History of the Civil War. Such a strain and stress period constitutes a natural etiological environment and since the World War we would expect a renaissance of this disease on both sides of the Atlantic. But notwithstanding cen-

Fig. 2. Typical string-sign extending into sigmoid flexure.

turies of extensive clinical observations, the present day authorities show interesting differences of opinion and often between-line evidence that the writers have had very limited personal experience with cases of this disease.

It is apparent from a comparison of authorities that mucous colitis is not always clearly differentiated from catarrhal and chronic ulcerative colitis. It is only by the examination of the discharged mucus that such a clinical differentiation is always possible. The mucus of the catarrhal form mixes and partially or wholly dissolves in water. The mucus of the chronic ulcerative form is always mixed with pus and often with blood. But the mucus of mucous colitis has undergone a transformation into

a semi-organized mucoid state so that it is coherent, tough and insoluble whether in frog-spawn-like masses or in membranes or tubular casts. Osler states that twice on post mortem examination he has seen these casts *in situ* partially separated from the colon without a lesion of the mucous membrane. Nowhere except in Gant have I found any dissension from the view that in mucous colitis we have a disease entity distinct from other forms of colitis. Notwithstanding this fact, many writers describe an etiology that would make mucous colitis a local disease of the colon of infectious or parasitic origin. Osler clearly differentiates the disease in the following words, after mentioning other causes of mucous discharges: "Thirdly, true mucous colitis, a secretion neurosis of the large intestine met with particularly in nervous and hysterical patients."

The roentgenological sign, which I describe in the illustrations as the *string-sign*, depends for its significance on the continuity of this mucoid material within the colon. Such a sign could not be expected in either the catarrhal or chronic ulcerative colitis. We have in the roentgen sign, therefore, as I hope to demonstrate, a means of differentiation second only to the water-test and not infrequently present at times when no mucoid specimens are obtainable in the stools.

In various other well-known works, medical, surgical and diagnostic, mucous colitis is either not mentioned or else dealt with so briefly and in such general terms as to be without value. In the volumes of the Mayo Clinic mucous colitis is mentioned along with angio-neurotic edema, the visceral crisis of the erythemas, abdominal angina and the crises of tabes as a cause of abdominal pain. But no other mention of mucous colitis could be found in the seventeen splendid volumes so largely devoted to gastrointestinal diagnosis and treatment. Other surgical works were found similarly barren. It is true that cases of mucous colitis have nothing that the surgeon can remove, tie, stitch or drain. His legitimate interest in mucous colitis would be to keep out of the abdomen where the abdominal pain is due to this cause. Hence, the dearth of references to this disease in general surgical literature. But in some of the semisurgical works by specialists in diseases of the rectum and colon, mucous colitis is described or misdescribed, sometimes with an etiology so arranged as to

Fig. 3. Typical string-sign confined to descending colon.

Fig. 4. Typical string-sign involving splenic flexure and a part of the transverse colon.

allow of an ingenious plea for a surgical interference that would be amusing if it were not tragic.

In roentgenological literature I found no reference under the title of mucous colitis. In Carman's great work on "Roentgen Diagnosis of Diseases of the Alimentary Canal" the following notice occurs in the chapter on Chronic Ulcerative Colitis.

"In his monograph, Schwarz describes and illustrates the roentgenologic findings in a few cases each of chronic catarrhal, mucous and ulcerative colitis. One feature common to all three varieties was a local or general narrowing of the colon, which was smooth and unhaustrated. In the catarrhal type, the contracted areas changed their situation rapidly. Notwithstanding the narrowing, the enema filled the colon very quickly. Besides the wandering diffuse contractions, exaggerated peristalsis and antiperistalsis were noted, indicative of a hyperirritability. In the mucous type, with the opaque meal, the shadow of the colon was persistently narrow and had a very peculiar flecked and marbled appearance, due probably to the bismuth-holding clumps of mucus. The ulcerative type showed a narrow, stippled colon-shadow with delicate arborizations.

"The cases of mucous colitis and catarrhal colitis which I have examined with the ingested meal or enema either gave negative findings, or at most showed only a vacillating spasticity of the bowel which had little diagnostic import. Permanently contracted and unhaustrated areas were not noted in any instance. I have not seen barium-holding clumps or bariumized mucous casts which might be considered pathognomonic of mucous colitis. This may have been due to the fact that they are not constant findings or that our cases were too recent."

FIG. 5. Barium string seen in the making. It is already well formed in the first portions of the transverse and descending colon. Evidently the barium is incorporated with some plastic material which stretches without breaking. Colonic spasticity and peristalsis are sufficient to complete the string.

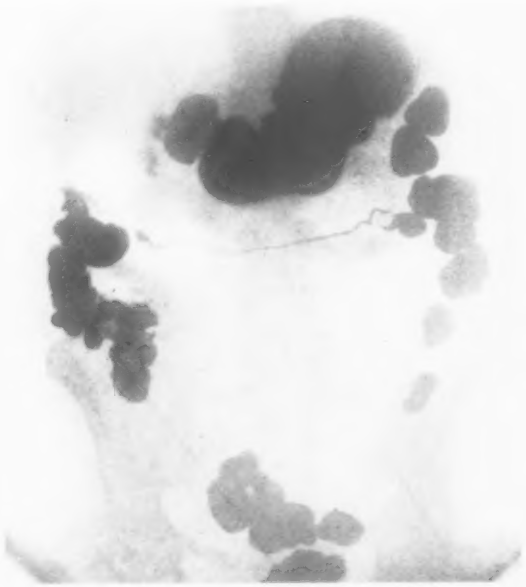

FIG. 6. Typical string-sign confined to transverse colon which is spastic, with normal bowel before and after. The string is drawn taut.

Of unpublished work in the roentgen examination of the colon in mucous colitis I have the following information. In Monographic Medicine, Volume III, under the head of Mucous Colitis, this sentence was found: "An x-ray examination will often reveal precisely the portion of the bowel affected." This being the only reference found by me regarding roentgen work in mucous colitis, excepting that already given from Carman, I wrote to the author, Lewellys F. Barker, asking the source of this statement, and received the following prompt and courteous reply:

"If I remember correctly the statement made on page 611, which you write about, was

based upon observations in my own clinic in association with the roentgenologist of the Johns Hopkins Hospital, Dr. F. H. Baetjer. We were influenced by two points: (1) the spastic parts of the colon seen in the x-ray in association with mucous colitis, and (2) an actual spotted and shreddy appearance due to the retention of the bismuth on the mucous coated surface after emptying the bowel."

In this letter of Barker's the idea of the roentgen examination in mucous colitis is clearly set forth and Baetjer's participation convinces me of the accuracy of the roentgen observations, although our own findings are not "a spotted or shreddy" appearance but a string-like appearance.

Fig. 7. The same case as Figure 6 two days before, showing normal colon.

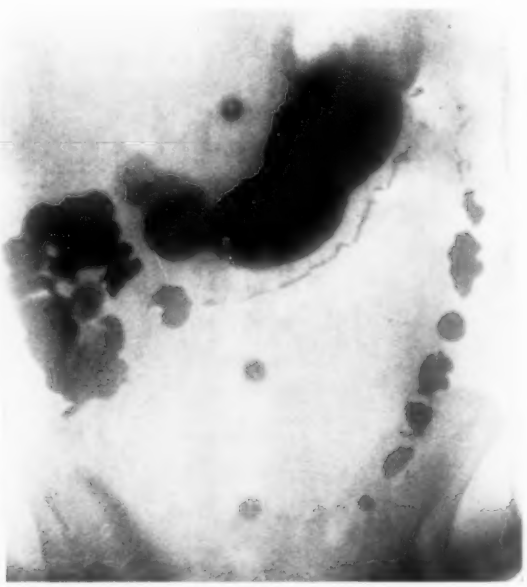

Fig. 8. A different but similar case to Figure 6 showing the barium string at a stage of beginning disintegration. Observe the regularity of the segments suggestive of a fixation by haustrations with a breaking of the string by peristalsis.

In order to miss nothing I applied to one of the firms making a business of supplying abstracts and asked for all references in the world's literature on roentgen-ray work in mucous colitis. They have not been able to find any such references in the literature except what I have already noted.

Particular interest and value attaches to mucous colitis because of its explanation of left abdominal pain. Pain beneath the left costal arch or in the left groin, in the absence of neoplasm or intestinal obstruction, has long been the despair of the roentgenologist. The one is like a left-sided gallstone colic; the other like a left-sided appendicitis. If a laparotomy has been performed then the surgical diagnosis is likely to be written down as "adhesions." The patient is sure to ascribe it all to "gas." And the roentgenologist, after negative findings, is not unlikely to look upon it as referred or reflex pain. But as a matter of fact these two left-side points are the especial points of localized pain in mucous colitis, particularly the point about the splenic flexure of the colon.

Another pain point is the midabdomen in cases where the mucous colitis involves the transverse colon as can be seen in the illustrations. This midabdominal pain may simulate almost any intra-abdominal affection, appendicitis, obstruction, peptic ulcer, mesenteric thrombosis, pancreatitis, general carcinomatosis, peritoneal tuberculosis, etc. It is never, as in the left hypochondrial localization of pain, directly suggestive of mucous colitis. But the roentgen string-sign as can be observed in the illustrations may be characteristic, perhaps pathognomonic.

In our series, the disease involves the descending colon in the majority of cases. It is interesting to note that Stockton, in Oxford Medicine, entirely upon clinical grounds, confirms this by the following quotation: "Rogers called attention to the fact that mucous colitis appeared in that part of the colon in which the bile had disappeared by absorption, pointing out that the action of bile is to prevent the coagulation of the mucus into membrane-like masses. It is a fact that from palpation and subjective symptoms we are led to believe that the descending colon is the part which is most involved in mucous colitis, it being a region in which free bile is not usually found." This explanation, however, is questionable because the string-sign may be present in the transverse colon and the descending colon appear normal whereas Rogers' theory would seem to require that the whole colon distal to the beginning of the affection must be involved.

FIG. 9. A different but similar case to Figures 6 and 8 showing the string apparently at the still later stage of disintegration.

FIG. 10. A barium string in the descending colon showing that the string may be drawn to a fine thread without breaking.

Some years ago, while in general practice, before the roentgen examination of the gastrointestinal tract was common and even before it was known, I was interested in mucous colitis from the view-point of the internist. Such a diagnosis had to be confirmed by specimens of the bowel discharge. Inasmuch as the mucus would be passed only by spells it was necessary to rely upon the patient to inspect the stools and bring in samples. Occasionally a sample would consist of nothing but gray-white mucus. Such a mass may be examined by simply mixing in a pail of water. In this way strings, membranes and casts can be floated free and recognized. Gelatinous masses like frog-spawn can also be recognized. In one of our cases a perfect tubular cast of the bowel 13 inches in length was thus floated out. Occasionally a tough string of mucoid material will be twisted firmly and through it may be seen a thin streak of blood.

This paper should have included a study of mucous casts recovered from the stools after barium administration, with a demonstration of the barium string outside the colon. If some one obtaining such a specimen can accomplish this I trust that the results may be communicated to me.

There are dangers in the diagnosis of mucous colitis. A patient with some surgical disease within the abdomen may suffer great anxiety because of an advised operation and may develop mucous colitis with abdominal pains due to this affection. If

now a consultant recognizing the mucous colitis, attributes all the abdominal conditions to this disease then a grave error of judgment may be committed. The signs of one disease may be overlaid and confused by the symptoms of another. When the roentgenologist is the consultant, his discovery of the roentgen signs of mucous colitis should be stated with proper reservations. Nothing but a complete examination with a discriminating analysis of signs and symptom complexes will be adequate.

Fig. 11. A barium string associated with a ptosis of the splenic flexure of the colon.

Fig. 12. String-sign associated with multiple diverticula of the colon.

The roentgen signs of mucous colitis have gradually intruded themselves upon me for many years without any organized effort of investigation. I noticed in certain cases of mucous colitis, a string-like distribution of the barium on the second day of the examination even when no passage had occurred. Usually this portion was the descending colon from the splenic flexure to the sigmoid, but occasionally also in the sigmoid. Less frequently it was the transverse colon. More rarely both the transverse and the descending limbs are involved. In still fewer cases have I seen this sign in the ascending colon. In addition to the *string-sign*, it is noticeable that the bowel may be filled excepting for the portion containing the string, as though a spastic contraction were present. It is on the plate made of the entire abdomen, on the morning of the second day of the examination by the barium method, that this sign is best exhibited. However, following a barium enema, if the patient is reexamined after visiting the toilet, a pseudo string-sign may be found occasionally in evidence.

When the disease was unsuspected and I have found the string-sign present I have, in a fair number of cases, gone back over the record of the case and extracted from the patient a history of mucous stools and often rather interestingly, the confession of some marked nervous strain and stress such as a financial crisis, domestic troubles or an overworked conscience. In such cases perhaps roentgenology and psychoanalysis touch hands.

How often cases of abdominal pain due to mucous colitis have undergone operation can never be known. Osler states that mucous colitis has been mistaken for appendicitis. No other disease so clearly illustrates the fallacy of the widely accepted belief that the surgeon can make a diagnosis by opening the abdomen. The

detection of the string-sign may save some patients from useless laparotomies or at least lead to a careful review of the whole case before operation is undertaken.

Whenever there is pain in the left side of of the abdomen, or spastic constipation alternating with diarrhea or a neurosis associated with intra-abdominal symptoms, or a history of nervous strain and stress, or noticeable mucus discharged in the stools, then suspect mucous colitis and look for the string-sign.

duction of the genuine barium string. Therefore this sign should be relied upon only when found after the administration of barium per os. Such a string connecting two portions of normal colon may be considered diagnostic if that portion of the colon occupied by the string can be shown at some other time to have a normal contour and caliber.

If the roentgen appearance of the colon following the barium meal in mucous colitis were due only to the retention of

FIG. 13. String-sign associated with congenital malformation of the colon.

FIG. 14. Same case as Figure 12 with colon filled showing left-sided position of entire colon.

The nature of the string-sign is not clear. It seems to be a product of three factors, namely: (1) the peculiar mucoid material of mucous colitis; (2) a spasticity of a considerable portion of the colon, and (3) some sort of peristaltic effort which gives length and thinness to the string. These factors may be studied in the illustrations but are better shown, of course, in a longer series of plates than can be printed with this paper. The traces of barium left in the descending colon after a barium enema are as a rule distinguishable from the dense but slender cord or thread of a true string-sign. An intimate mixture possibly during the formation and separation of the mucoid material in the colon is apparently required for the production of the barium string. barium in the mucoid material adherent to the lining of the bowel, then this appearance might be expected to be "spotted and shreddy" as described in Barker's letter or peculiarly "flecked and marbled" as described by Schwarz. Such an appearance on theoretical grounds might be illustrated by Figure 1. But this was not a case of mucous colitis. At operation it was proven to be a case of extensive polyposis. It is shown as a contrast to the *string-sign* which I consider to be the more distinctive roentgenological sign of mucous colitis.

Occasionally the appearance is that of multiple threads or of a loose rope—perhaps before the string is pulled taut. The string may be drawn to a fine thread without breaking, as in Figure 10, or we may

find the broken or interrupted string, as in Figure 8.

It has been stated that the enteroptosis especially in the so-called Glenard's disease is a predisposing cause of mucous colitis. This is not common in our experience but it does so occur. Another anomaly is in association with multiple diverticula of the colon. Congenital malformations of the colon have been stated also to be a cause.

A differentiation from chronic ulcerative colitis is found in the normal colon outline

Fig. 15. Pseudo string-sign after a barium enema following a visit to the toilet.

when properly filled either by a barium meal or by the barium enema. Figure 6 shows the string-sign, and Figure 7 the colon after the barium meal. Many examples of this kind could be shown.

The string may lie opposite the appendix and be a cause of left-sided abdominal pain (Fig. 12) or it may involve the splenic flexure and be a cause of left-sided pain below the costal margin. The pain is located between the umbilicus and the edge of the ribs in the nipple line in the majority of cases of mucous colitis irrespective of the exact location or extent of the involvement, so long as the splenic flexure is included.

The string-sign may involve any part of the colon, the ascending colon least often, the transverse only at times, most often the descending colon and rarely the sigmoid.

The spasticity of the colon as a factor in producing the string-sign is evident where the string is produced without an emptying of the bowel (Fig. 6). You here see normal, filled colon before and after the string.

In looking over these illustrations it may be seen that there is such a sign as a barium string that cannot be explained by traces of barium adhering to the colonic mucosa. Whether this sign is pathognomonic of mucous colitis may be disputed, but I am convinced that it occurs in relation to spasticity of the colon, psychoneuroses and abdominal pain. I do not doubt the observations of Baetjer and Barker or of Schwarz and believe that at times the adherent mucoid casts of the colon may reveal their presence by the roentgen appearance described by these authors. But from my personal experience I would conclude that the string-sign is a more frequent and definite sign of this non-surgical cause of abdominal pain.

If these signs of mucous colitis can be verified by other roentgenologists then we will have established the curious fact that in the colon is to be found the roentgenological evidence of a psychoneurosis.

DISCUSSION

Dr. James T. Case, Battle Creek, Mich. I am very much interested in Dr. Crane's presentation, and thank him for it. It seems to me, however, we should recognize that mucus is normally present in the bowel to a certain degree; and some of the appearances in the colon, following the mass movements which are the normal mode of progress of contents through the bowel, are a result of the small amount of mucus which is normally present, some appearances which are string-like and which I believe I recognized in some of the films which Dr. Crane showed. Others I believe are very characteristic of mucocolitis; those in which there is a definite string which has not the serrated edge, which is rather a smaller and more definite string-like appearance, I believe, are definitely mucous colitis.

I recall presenting to this Society some twelve years ago a slide of such a case in which by enemas we were able to recover from that

patient a string of mucus nearly a yard in length which had a twisted appearance, and on untwisting this string of mucus we were able to see barium inside the string. So I am of the opinion that such a string does represent a mucous colitis and that it is a definite, specific finding, but it requires careful differentiation from normal, physiological conditions.

Dr. Crane brings out the fact that mucous colitis has as its basis a neurologic lesion, a neuropathic constitution, at any rate. But it seems to me we should also recognize that these cases of mucous colitis do not necessarily exist as purely mucous colitis. We can have mucous colitis plus catarrhal colitis, or plus even the ulcerative colitis; it can be a mixed lesion; but in all of these cases, even of the mucous colitis, we find back of it all, and before the mucous colitis existed, a lesion of the nervous system.

I believe it is a very important thing in interpreting the films or the screen findings of the colon following the barium meal to know the relation of the last preceding bowel evacuation to the picture we are studying, because if one studies the colon within anywhere from five to fifty minutes following a bowel evacuation he is apt to see an uneven distribution of the barium in the colon, particularly the transverse and descending colon, the masses being somewhat irregularly disposed and connected by narrow shadows which are somewhat string-like; but which I think we must be careful to differentiate from mucous colitis. In other words, a mass peristaltic movement of the colon may leave just such shadows as have been seen in some of Dr. Crane's slides, I believe.

The case of polypi, I think, represents a somewhat different picture than I had in mind for the flake-like shadow of ulcerative colitis. The cases of colitis are shown by flake-like shadows in the colon, giving what someone called the "snowstorm" appearance, due to the many flakes of barium adhering to the wall of the bowel, thanks to the mucus. We usually see that shadow brought out by the presence of gas in the colon, and one can pick out the individual flakes of mucus very nicely in those cases.

It seems to me we must recognize that there are mixed lesions, that mucous colitis does not necessarily exist alone but when we do find the characteristic strings shown by Dr. Crane, having excluded the physiologic appearances above noted, then I believe we definitely have cases of mucous colitis.

Dr. A. H. Pirie, Montreal. I would like to know if we are to diagnose mucous colitis in all cases where we get this string that Dr. Crane describes to us. I have seen it so often and usually I always ask the patient if a bowel movement has taken place shortly before and they reply yes, and I have always looked upon it as simply following the bowel movement.

I would like Dr. Crane to tell us the differential diagnosis between the mucous colitis string and the string seen immediately after a bowel movement or if he considers that there is a difference.

Dr. E. S. Blaine, Chicago. I would like to ask Dr. Crane if he considers a string-like sign sufficiently pathognomonic to make that diagnosis a definite one in spite of negative clinical findings.

Dr. Crane (closing). I think that there is a mistake about the frequent appearance of the string following evacuations of the colon. If you will observe the colon after evacuation from enemas or after the barium meal by mouth, you will find that a string-like retention is not a common finding. I took the pains to look over approximately 2,000 cases which we had in our files and what conformed to the rules of the string-sign I found in between 3 and 4 per cent of those cases. This, however, does not give the per cent of mucous colitis.

Mucous colitis as a cause of pain is of real importance to the roentgenologist. In not all of the cases which I showed you did I have the clinical evidence of mucous colitis. You cannot always find the signs of mucous colitis at any given time. A patient will pass the membrane only at intervals and then often only after some marked nervous upset. I could give numerous examples from previous experience in general practice of medicine. I don't know how much significance should be placed upon this sign. I hoped in bringing it up to you that before many years have passed I will know something more about it from the collective experience perhaps of the Society. I think it is worth while to look for it and I hope that in time we may look upon it as a pathognomonic sign. It is always so suggestive that clinical observation should be made following the appearance of such a sign. In the cases of left-sided abdominal pain, the presence of a definite string should certainly lead to a careful review of the case.

THE ROENTGEN DIAGNOSIS OF LESIONS OF THE UPPER URINARY TRACT UNASSOCIATED WITH CALCULUS

BY W. McL. SHAW, M.D.

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HOW often do we see a patient referred to the roentgenologist for the usual urinary tract examination, complaining of "pain in the back." These patients, after a few films over the kidneys, ureters, and bladder, are informed that calculi are absent and the examination considered "negative." In such cases, can we not frankly ask ourselves if we have rendered this patient the full service and benefit our specialty affords? Entirely too much significance is attached to the "negative" report for stone. Many renal and ureteral lesions go undiscovered in an examination consisting simply of a few films made of the urinary tract in search for urinary calculus.

The incidence of stone in proportion to upper urinary tract lesions is clearly reflected in a recent series of cases reported from a large hospital situated in one of our leading medical centers.[1] In this series out of a total of 1,326 roentgen examinations for suspected urinary calculi, there were only 213 cases with positive findings for calculus, or 16.04 per cent. We ask ourselves, what of the 1,113 "negative cases?" Is it reasonable to believe they were all normal? It is with this large percentage of routine urinary tract examinations that yield no evidence of urinary calculi that this paper deals. It is not the aim or scope to deal with the diagnosis of stone in any way.

Only by the very close cooperation of the urologist with the roentgenologist, can the full diagnostic benefits accrue to the patient from the work of each. It is particularly in this large class of urinary tract lesions not due to calculus that the best results of combined work manifest themselves. This resulted from the development of the cystoscope as well as refinement in roentgen apparatus and technique. Both specialties have advanced rapidly, each depending upon electricity for their existence.

The close cooperation of urology and roentgenology has led to the perfection of the combined urological and roentgen-ray table, of which there are several good models at present.

The properly made uretero-pyelogram constitutes the greatest single factor of this combined work in throwing light on these obscure lesions. No less an authority than Young[2] states: "Suffice it to say that the uretero-pyelogram is our most valuable diagnostic method for clearing up these puzzling conditions."

It was in 1906 that Voelcker and Lichtenberg[3] made the first pyelogram. They used collargol for injection and thus began the close association of urology and roentgenology. Many salts and solutions have been used for the injection beginning with the silver preparations at first down to the present when the iodide of sodium in 15 per cent solution is almost universally adopted. This salt combines the advantage of easy preparation, low toxicity, and good density on the film. The method properly executed is harmless. Several deaths were reported by the early workers, all of which were traced to the forced injection of large amounts of injurious silver salts. Air has also been used as a medium for injection, but because of its easy confusion with gas in the gastrointestinal tract, its use has largely given way to the opaque salts in solution.

A properly combined study of the upper urinary tract at present consists in cystoscopy, preferably on a combination urologic and roentgen examining table, with a careful inspection of the vesical mucous membrane and ureteral orifices. This being done, the ureters are catheterized with roentgen-ray catheters, and if hydronephrosis is suspected, the urine is aspirated from the suspected kidney, noting the amount. Separate specimens of urine from the kidneys are collected for microscopic study, culture and guinea

pig inoculation. A kidney function phthalein test is done separately on each kidney. At this point, the patient is turned over to the roentgenologist, who makes several exposures preliminary to the uretero-pyelograms, using the Bucky diaphragm. These films are made over the kidneys, ureters, and obliquely downward over the bladder. These are valuable for evidence of calculus. Next the urologist injects very slowly (from a syringe, or by gravity) with practically no pressure, from 5 to 8 c.c. of a 15 per cent solution of sodium iodide through the catheter. A sensation of fullness or pain will usually be felt in the injected side when about 8 c.c. have entered. At this time, further exposures are made, of course with suspended respiration. These are made over the kidneys, then the catheters are pulled down several inches without withdrawing the solution. This should bring the distal tip of the catheter to about the brim of the true pelvis or slightly higher, leaving the course of the ureter above it free to fill and assume a natural position when injected. Maintaining the opaque medium in the ureter and kidney pelvis, a further exposure is made over the course of the ureter. This will show the shape, size, and position of the ureter besides demonstrating kinks, strictures, obstructions of the ureter, or hydro-ureters. Films made with the ureter and kidney pelvis injected should be made in both horizontal and vertical positions to demonstrate a ptosis of the kidney, and some lesions of the ureter. After securing the necessary uretero-pyelograms, the solution may be withdrawn and films made at this time will give an idea of the conditions of drainage existing in the kidney and ureter. Double pyelograms are of considerable help but when followed by pain cause twice as much discomfort. The catheters may now be removed unless there is some indication of their retention, such as drainage of a hydronephrosis, etc., and the patient returned to bed with the usual post-cystoscopic treatment.

The pyelogram properly made and interpreted offers the most valuable and conclusive proof of a larger number of renal lesions than any other diagnostic effort. Its use is imperative in all lesions of a doubtful nature. Its diagnostic value in the following cannot be overemphasized:

1. Normal kidney.
2. Hydronephrosis.
3. Pyelitis.
4. Pyonephrosis.
5. Renal tuberculosis.
6. Renal and ureteral anomalies.
7. Cystic kidney.
8. Identification and localization of renal shadows.
9. Identification and localization of ureteral obstruction.
10. Renal tumor.

We will discuss these conditions separately.

1. *Normal Kidney* (Fig. 1). There are several types of normal; a recognition of each follows only after considerable experience. The most common type encountered is usually the division into a single pelvis with three main or major branches, or calyces, each of which again divides into minor branches, or calyces, usually cupped or concave on their outer margins when properly filled. There are many variations of the normal pelvis. The exact outline of the normal ureter can be secured in the same manner, making sure the catheter is pulled down enough to allow the solution to enter the ureter in its natural position.

2. *Hydronephrosis* (Fig. 2). Frequently by pyelography alone can early hydronephrosis be diagnosed. The typical changes of dilatation of the renal pelvis and calyces resulting in the typical "plug hat pelvis" described by Keyes[4] in 1909 have been repeatedly called to our attention by various workers. It is not an uncommon occurrence in pregnancy from pressure. Here ureteral catheters often are left *in situ* for hours. Any obstructive lesion of the ureter may produce a hydronephrosis. This obstruction may be at the uretero-pelvic junction or at any point in the ureter.

3. *Pyelitis.* Here the changes found on the pyelogram manifest themselves as a slight increase in the size of the kidney pelvis and slight evidences of inflammatory changes in the calyces.

4. *Pyonephrosis* (Fig. 3). When inflam-

Fig. 1. Normal uretero-pyelogram.

Fig. 2. Normal pyelogram, right side; slight hydronephrosis, left side.

Fig. 3. Pyonephrosis.

Fig. 4. Renal tuberculosis, left kidney.

Fig. 5. Movable kidney, vertical position (see Fig. 6, same case).

Fig. 6. Movable kidney, horizontal position (see Fig. 5).

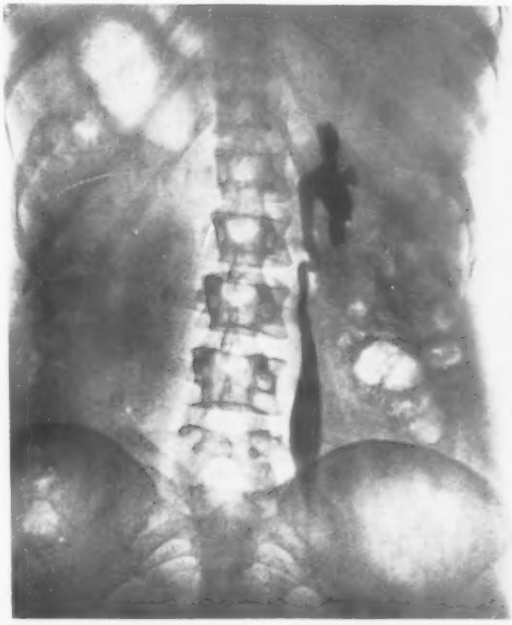

Fig. 7. Hydro-ureter, apparent kink (see Fig. 8, same case).

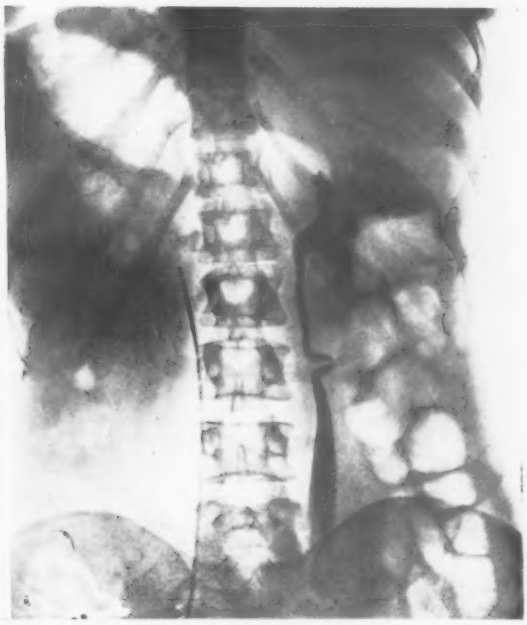

Fig. 8. Hydro-ureter, kink produced by catheter (see Fig. 7).

matory changes in the kidney pelvis or calyces have progressed to actual necrosis of kidney structure, we see these changes best on the pyelogram. These represent the large pus kidneys. They result in a loss of kidney structure, often very extensive, revealing itself in pockets or cavities in which the opaque solution shows very plainly. The pyelogram indicates the amount of kidney destruction and its location.

5. *Renal Tuberculosis* (Fig. 4). Here the diagnosis can often be suspected without the aid of the pyelogram. The formation of casts of the kidney pelvis, or very large and often branched stones, is always suspicious of renal tuberculosis. It is often associated with a large kidney. In the advanced stage, however, the kidney pelvis is contracted and distorted from the normal on the pyelogram.

6. *Renal and Ureteral Anomalies* (Figs. 5 and 6). Here the uretero-pyelogram stands alone as the diagnostic ideal. The most common congenital changes are movable kidney, horseshoe kidney, single kidney, duplication of the ureter and kidney pelvis, and the presence of aberrant vessels.

7. *Cystic Kidneys.* These may be single (monocystic) or multiple (polycystic). They manifest themselves as a pressure defect on the pyelogram with resulting deformity in pelvic contour.

8. *Identification and Localization of Renal Shadows.* The pyelogram brings out the minute position of all suspicious shadows in their relation to the kidney pelvis, calyces, parenchyma, upper or lower pole, etc. Occasionally, a gallstone may be confusing and the pyelogram made in the oblique position identifies the shadow as falling without the right kidney.

9. *Identification and Localization of Ureteral Obstruction* (Figs. 7, 8 and 9). The exact nature of a persistent ureteral obstruction resulting in impaired drainage and kidney function is often rather puzzling. The uretero-pyelogram often differentiates between an obstructing calculus, ureteral kink, stricture or torsion. Here again the importance of withdrawing the catheter to the lower end of the ureter before injection should be emphasized.

10. *Renal Tumor* (Figs. 10 and 11). The early clinical recognition of renal tumor is one of the most difficult diagnostic problems. Renal tumor has a very insidious onset. The three classical symptoms, viz., hematuria, pain, and palpable tumor, were found in only 44 per cent of a series of 413 reported cases of malignant tumors of the kidney by Stevens (quoted in paper by Meyer[5]). Pyelography revealed definite evidence in practically every case of this series. Thus, we must realize that any method tending to lend accuracy to such a difficult diagnosis will immediately be of inestimable value. So much reliance is now placed upon the pyelogram in tumor of the kidney that it is most unusual to diagnose it before combined cystoscopic and roentgenological examination. This, of course, does not apply to infants and very young children. The diagnosis is indicated by changes in contour of the kidney pelvis or calyces, these showing marked varieties in shape and size. Changes in the kidney shadow in shape and size are also suspicious of tumor. Of the varieties encountered, there are many. By far the most common is hypernephroma. This is graphically illustrated in that 36 out of 38 renal tumors reported at Mt. Sinai Hospital,[5] New York City, were hypernephromas. This shows an average of 95 per cent. The Mayo Clinic[5] reports 68 hypernephromas out of a total of 92 renal tumors, or 78 per cent. Other primary tumors of the kidney parenchyma are adenoma, carcinoma, sarcoma, teratoma, and the several benign connective tissue tumors; of the kidney pelvis, papilloma, papillary carcinoma, and squamous cell epithelioma. The final diagnosis in the majority of these, necessarily, is made by the pathological slide, but their location and relative size can be determined rather accurately by careful pyelograms.

11. *Perirenal Abscesses* (Fig. 12). This comparatively rare condition produces evidence on the pyelogram not altogether dissimilar to some tumors. There is pressure against the pelvis or calyces from without, displacing or distorting them. The clinical picture is usually quite sufficient to differentiate the two, in that in

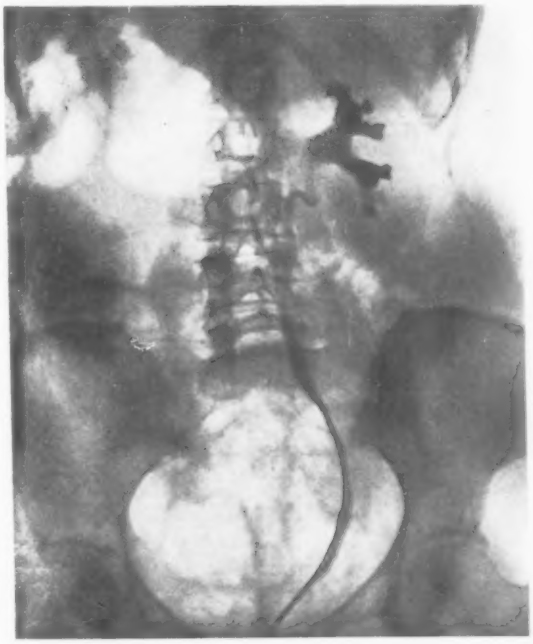

FIG. 9. Ureteral kink.

FIG. 10. Papillary tumor of kidney pelvis.

FIG. 11. Tumor obstructing upper and middle calyces.

FIG. 12. Perirenal abscess, right kidney.

perirenal abscess, the usual septic picture of infection is present.

It is hoped that this short résumé of the possibilities of combined team work of the urologist and roentgenologist will stimulate a more careful and cooperative study of the ambulant patient frequently coming to our offices with the common complaint of "pain in the back." As emphasized above, this calls for vigorous adherence to detail and careful team work between urologist and roentgenologist.

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OBSTRUCTIVE EMPHYSEMA

CASE REPORT*

BY J. A. WILSON

Major, Medical Corps

U. S. ARMY

IT is felt that this case should be reported because of certain unusual features, although the cause of the condition has not yet been established nor the line of treatment determined.

Mrs. X, aged thirty-seven, married, wife of an army officer. The family history is negative. She has had the usual diseases of childhood with a good recovery in each case. Her health otherwise has been unusually good. She has been fond of athletics, particularly tennis and mountain climbing and has shown more than average endurance in these sports. She graduated from high school and college and was married in 1913. She had a normal childbirth in 1914. In the same year the appendix and right tube were removed. In 1921 the patient had a miscarriage at five months. Apart from these incidents this patient's health has been good and she had continued her athletic indulgence with unabated vigor until her present illness.

In 1923 she accompanied her husband to the Philippine Islands. In the spring of 1924 she became somewhat run down, ascribable to the heat and her social duties, and spent a month at a mountain resort, elevation 5000 feet. During the month she led an active outdoor life with much tennis and mountain climbing, and felt as well as she ever had and noticed no limitation as to her physical activities. She continued to feel well after her return to sea level until the winter of 1924–25, when she developed a series of slight colds which persisted during most of the winter; she noted during these colds that she had difficulty in getting sputum up from her lungs. She played a little tennis during the winter but did not note any disability. In April, 1925 she again went to the same mountain resort and on attempting to take part as before in tennis and mountain climbing found that any exertion produced extreme shortness of breath and great fatigue. This condition persisted and prevented her indulgence in any but the mildest of exercise. On one occasion when stretching a tennis net she was seized with a sharp pain in the back; the pain persisted and she went to bed, believing the pain was caused by her menstrual period which was about due. The pain disappeared after a day's rest but her period did not occur until several days later.

After a month at this mountain resort she returned to her home. On the way down she developed an acute tonsillitis and after arrival at her home called in a medical officer who in the course of his examinations noticed an irregularity in the chest movement on breathing. A roentgenogram was made and the condition illustrated by Figure 1 was found, and she was at once admitted to an Army General Hospital

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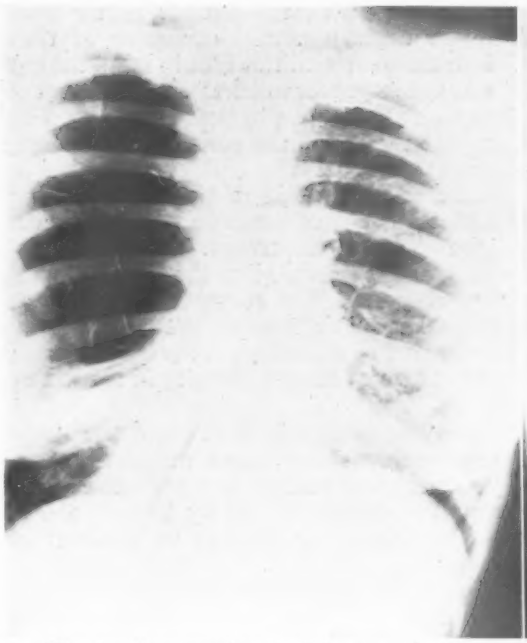

Fig. 1. The fine lines crossing the left upper chest have been slightly retouched in this as in all other figures. On the original plates these lines are much more numerous than on this figure and under the stereoscope are seen to be within the supposed cavity.

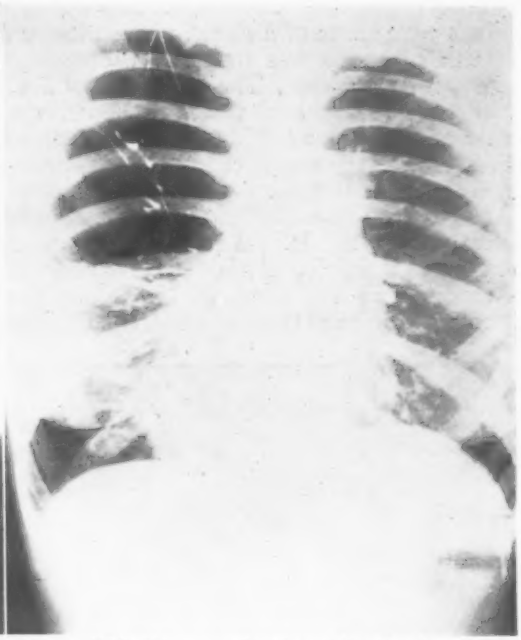

Fig. 2. This film was taken immediately after the injection of 1 c.c. of lipiodol well into the middle of the supposed pneumothorax cavity. Most of it has collected at the bottom of this cavity showing that the alveolar walls are largely broken down.

Fig. 3. This film was taken at the same time as Figure 2, except that the patient was lying on the left side.

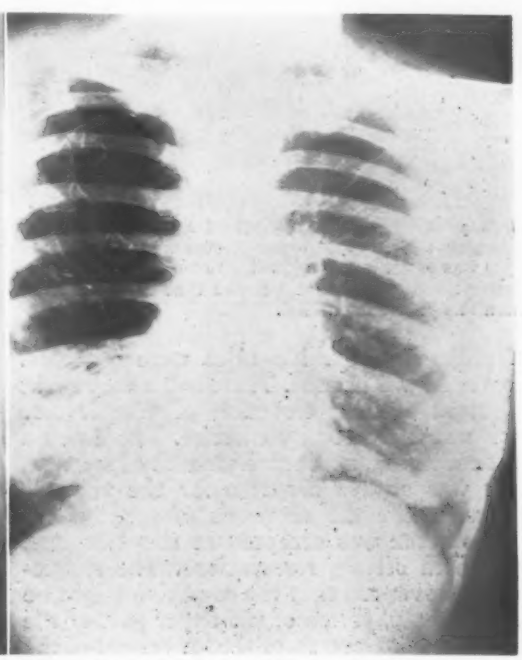

Fig. 4. Roentgenogram taken twenty-four hours after the lipiodol injection and shows clearly a partial pneumothorax affecting principally the emphysematous portion of the lung.

for observation and treatment. The clinical findings were those of a closed pneumothorax, and this diagnosis was made. A tuberculous etiology was assumed. The patient was held under observation and treatment until the winter of 1925–26, when she came back to the States. No change was noted in the chest condition during that time.

The patient was admitted to the Fitzsimons General Hospital in February, 1926. The roentgen examination showed no change from the condition as it was ten months before; the clinical findings were those of a nearly complete

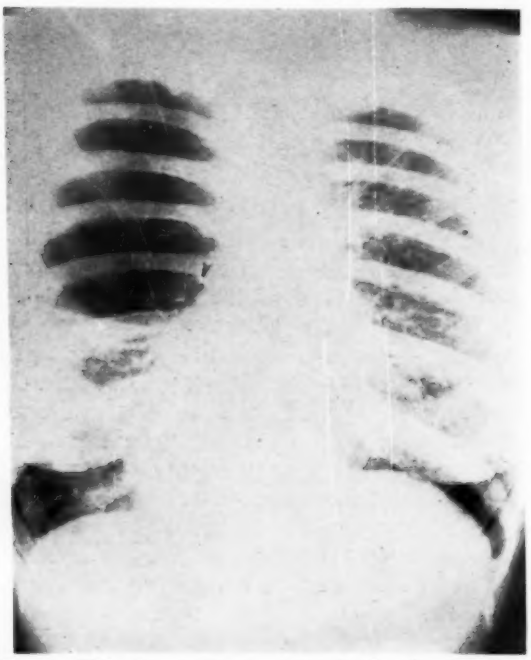

Fig. 5. This figure shows more clearly the fine lines crossing the supposed pneumothorax cavity. The film was taken after the withdrawal of air from the emphysematous area and shows that the atelectatic area has partly expanded.

left pneumothorax. No râles were detected. Her weight was normal. There was a very slight inconstant evening elevation of temperature which was increased by exercise. There was a slight cough and a minimal amount of sputum, which was always negative for the tubercle bacillus. While the diagnosis of spontaneous pneumothorax was accepted at this Hospital, it was with certain reservations. The suggestion was advanced that the condition might be due to an emphysema of the upper part of the lung with an atelectasis of the lower part of the lung. The possibility that the emphysema was obstructive in type was not considered at the time and it was thought possible that the effect of gravity with the patient partly inverted might cause a partial expansion of the atelectatic area; with this idea in mind the patient was put in bed for a short period, the foot of the bed elevated and physical signs noted before and at the end of the period, and a roentgenogram taken at the end of the period. No decrease in the size of the supposed emphysematous area or expansion of the atelectatic area was demonstrated. In March, 1925, lipiodol was injected into the trachea through a bronchoscope. The roentgenogram showed a normal bronchial tree on the right and in the lower part of the left lung. No lipiodol was seen in the area of lessened density in the left upper chest.

As no decrease in the size of the supposed pneumothorax had been noted in nearly a year's time, an attempt was made to expand the supposed collapsed lung by tapping the chest and aspirating air through an artificial pneumothorax apparatus. During a period of six weeks air was withdrawn on eight occasions at about weekly intervals in amounts varying from 300 c.c. to 700 c.c. The initial readings in c.m. of water were from -1 to $+1$; after the aspiration of air they varied from -4 to 0, to -7, to -3, depending on the amount of air withdrawn. A roentgen-ray check on this treatment showed a definite, though temporary, partial expansion of the collapsed lung (?) after withdrawal of the larger amount of air. This treatment caused some pain and distress and was discontinued because the lung failed to show any permanent expansion.

On June 1, 1926, one c.c. of lipiodol was injected through a long needle into the center of the supposed pneumothorax cavity and roentgen films, taken immediately after, with the patient both in the upright and reclining positions, showed (Figs. 2 and 3) a pocketing of part of the lipiodol in the middle of the cavity and also enabled one to visualize imperfectly some thin, nearly transparent membranous walls; the films could only be interpreted as those of a marked local emphysema. Films taken the next day (Fig. 4) showed that we had accidentally induced a true partial pneumothorax of the emphysematous area and confirmed the diagnosis beyond the question of a doubt.

After the partially collapsed lung had expanded following the accidental true pneumothorax (about 3 weeks) the patient at my advice visited the Mayo Clinic, where a bronchoscopic examination was made, lipiodol injected into the bronchi, and a partial pneumothorax induced for diagnostic purposes. Our diagnosis was confirmed at that Clinic.

Roentgen films and roentgenoscopic examinations at our Hospital also showed the mediastinal shifting so frequently noted in obstructive emphysemas. A later bronchoscopic search for a cause of the obstruction revealed a patent main left bronchus and left lower lobe bronchus; the left upper lobe bronchus could not be seen.

DISCUSSION

Obstructive emphysema is mentioned in the literature almost without exception in connection with foreign bodies or tumors of the bronchial tubes. A thorough search of the English literature reveals no case in which mention is made of such severe degree of emphysema; neither do plates illustrating these articles indicate any such marked emphysema. In other words, in the cases reported the dilatation of the alveoli was neither so marked nor extensive that the emphysematous area was not at once recognized as being a part of the pulmonary tissue. In the present case the emphysema was of a much more severe degree. The roentgen films were seen by at least three Army roentgenologists who were thoroughly familiar with true pneumothorax cases; the possibility that the condition was other than a pneumothorax was hardly considered. Our Army phthisiologists, almost without exception, accepted without question the pneumothorax diagnosis. These plates were kept in the office of the Chief of Medical Service for several months and were frequently shown to visiting physicians, many of whom were roentgenologists or phthisiologists of more than local repute. Without exception they stated their belief that the condition was a pneumothorax.*

Two points are of importance in the differential diagnosis: (1) Crossing the supposed pneumothorax cavity in all directions are what appear to be a number of fine almost thread-like adhesions; these are much finer than pleural adhesions ever are, they are more numerous, and they cannot be traced to a definite parietal pleural and pulmonary pleural attachment. In the figures illustrating this article these lines have been retouched. (2) The supposed collapsed lung in this case was collapsed toward the base and not toward the mediastinum. Often adhesions will hold a partly collapsed lung to a part of the diaphragmatic pleura. In this case the supposed collapsed lung covered the diaphragm completely and filled in the costophrenic sinus and lower part of the chest up to the level of the fifth rib. This was not at all like the usual collapsed lung in pneumothorax.

In this case the cause of the obstruction has not as yet been determined. It is possible that it is due to a non-opaque foreign body which is lodged in an upper lobe bronchus. Such a foreign body may have been aspirated without the patient knowing of it or remembering it. Against the theory of foreign body occlusion is the absence of sepsis, abscesses or purulent sputum. Also two bronchoscopic searches of the bronchial tree were negative. It therefore seems to me more probable that the obstruction is due to a polypoid growth in one of the upper lobe bronchi or to pressure on such a bronchus by an enlarged bronchial lymph gland.

This patient has been reduced from a condition of unusually good health to that of an invalid and it is obvious that something should be done if too great risk is not involved. It does not seem probable that further bronchoscopic surgery will remove the obstruction, though I should like to see another attempt made. If such an attempt fails only two other measures can be suggested, and these are suggested only because it is believed that only a small part of the upper lobe is involved in the emphysema and that the collapsed greater portion of the lung is perfectly healthy and quite capable of carrying on normal respiratory function if it can be released from compression by the emphysematous area. The first measure suggested would be to repeatedly and frequently withdraw air from the emphysematous area by means of an artificial pneumothorax apparatus, using a long fine needle and attempting to break up as many of the distended alveolar walls as possible by free movement of the point of the needle, hoping that the traumatized alveoli where brought in apposition by the aspiration of the emphysematous

* Apparently the same difficulties in diagnosis were encountered at the Mayo Clinic, a personal communication from that Clinic assures me that no similar condition had ever been seen there.

area may completely collapse and heal and so ultimately greatly reduce the emphysematous area. As for the second measure, an artificial pneumothorax might be again induced and the emphysematous area could be cauterized through a thoracoscope. Both of these measures are fraught with danger and are only tentatively suggested.

ROENTGENOLOGIC STUDY OF THE CHEST IN THE TERMINAL STAGE OF PULMONARY TUBERCULOSIS*

AN ANALYSIS OF ONE HUNDRED POST MORTEM ROENTGENOGRAMS

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WEST PALM BEACH, FLORIDA

THE anatomy of the thorax and of its contents makes possible the roentgenographic demonstration, in minute detail, of many intrathoracic processes. The contrasting densities of the ribs, heart, aorta and diaphragm enable the roentgenologist to accurately locate intrathoracic pathology in its relation to surface topography.

Stereoscopic roentgenograms, properly interpreted, further localize pathological densities in the chest, and their interrelations. Stereoscopic roentgenography is essential in chest examination. A single roentgenogram gives valuable information, but one cannot gain the same intimate knowledge of an intrathoracic pathological process from a single film as from stereoscopic films. In pulmonary tuberculosis this intimate knowledge is necessary, not only for correct diagnosis, but for reasonably intelligent prognosis and treatment. The recognition of the general type of tuberculosis present, the degree and location of protective fibrosis, the extent and location of cavities, and the appreciation of the probable life history of the tuberculous lung infection in the particular patient being studied, have a vital bearing upon the diagnosis, prognosis and treatment. This knowledge can be gained from study of properly taken stereoscopic roentgenograms.

Roentgenologic study of patients in the early and moderately advanced stages of pulmonary tuberculosis is not difficult. This type of patient can coöperate in securing satisfactory roentgenograms. In the later and terminal stages of the disease, when rapidity of respiration is present, and the patient is ill and restless, where transportation of the patient to the roentgen-ray room is not advisable, satisfactory roentgenograms are not so easily obtained. The roentgen machine must be taken to the bedside, longer exposures are necessary, and satisfactory single or stereoscopic roentgenograms may not always be obtained.

When the disease in the lungs reaches an advanced stage, and the outcome will certainly be fatal, interest in the progress of the disease too often ceases, and the final notes on the clinical chart are brief and non-illuminating. The occurrence of a spontaneous pneumothorax, a perforated intestinal ulcer, or an unexpected improvement in the condition of the patient may revive the waning interest of the attending physician. Too often, however, observations in the terminal stages of the disease are superficial and incomplete, and our knowledge of the end processes of the disease is not increased.

During the period from September, 1920, to October, 1922, the writer was stationed at The Fitzsimons General Hospital, United States Army, Denver, Colorado, in charge of the roentgenological service. The major-

*From the Roentgenological Department of the Fitzsimons General Hospital, U. S. Army.

ity of the patients in this hospital were under treatment for pulmonary tuberculosis. The average hospital population for the period mentioned was about one thousand. A well-formulated policy obtained in this hospital concerning roentgenological examinations of the patients therein. Examinations at frequent intervals throughout the course of the patients' hospitalization period made it possible to closely follow the changes in the appearance from a roentgenological standpoint and compare those changes with the changes in the clinical examination of the patients, the symptomatology, the temperature range, amount of sputum, cough, etc.

Largely at the suggestion of Major Corydon G. Snow, the pathologist, to whom the writer is deeply indebted for many valuable comments, the writer began, early in November, 1920, to take stereoscopic roentgenograms, both in the prone and supine positions, of the patients dying in the hospital. For various reasons the immediate roentgenologic examination of all bodies was not possible. Later study showed that the interposition of a few hours between the time of death and the roentgenography did not result in sufficient post mortem changes to be demonstrable. This refers only to the thorax. Not all of the patients dying in the hospital during the period mentioned were examined roentgenologically post mortem. In some instances the bodies not examined roentgenologically were later subjected to necropsy. During the period from November 26, 1920, to September 18, 1922, two hundred and thirty patients were examined by roentgenograms post mortem; 109 patients were examined post mortem both roentgenologically and pathologically. Of these 9 showed no evidence of tuberculosis of the lungs. We have, therefore, 100 post mortem roentgenograms of the lungs, in all patients stereoscopic, for analysis in this paper.

The stereoscopic roentgenograms of the chest, taken post mortem, were studied prior to necropsy, and fully reported. At the necropsy table the films and the report were discussed before the body was opened. The roentgenological analysis of the chest pathology was made independently of the necropsy findings. Naturally some errors were made in the roentgenological analysis of the intrapulmonary and pleural lesions, but in the large majority the analysis was correct. Careful pathological examinations, completely reported, made it possible to restudy the films and later evaluate the intrathoracic densities on the roentgenogram in terms of demonstrable pathological processes by necropsy.

The anatomy of the lung, so ably described by William Snow Miller, needs no discussion here. The reader is referred to the writings of the above author for detailed description of the lung anatomy. The classification of tuberculosis, presented several years ago by Kennon Dunham forms the basis of the classification used by the writer in the reports on the patients discussed in this paper. Certain minor modifications have been made in the classification in order that the same classification might be used in recording the results of clinical examination and in recording concepts of pathology as shown on the roentgenogram. The writer is indebted to Lieut. Col. E. H. Bruns for most valuable suggestions in arriving at a satisfactory working classification.

The classification of pulmonary tuberculosis is made necessary for purposes of record. The recording of impressions gained from study of a patient, either by clinical methods of examination, or by roentgenological examination, in an orderly manner and in general conformance with a broad classification, presupposes a more thorough examination than is necessary to simply label a patient as one suffering with a pulmonary tuberculosis. In this series the predominant type of lesion determined the class. If two distinct types of lesions were present in the same patient, both were recorded. Naturally, if one wished to be correct, he would place all advanced cases into the mixed type, inasmuch as most advanced cases present all types of lesions, in various stages of production, degeneration, cavitation and fibrosis. Broadly speaking, however, classification is not difficult.

THE CLASSIFICATION OF PULMONARY TUBERCULOSIS

1. Acute miliary tuberculosis.
2. Acute disseminated tuberculosis.

3. Caseous tuberculous bronchial and lobar pneumonia.
4. Mixed type, fibro-caseous and caseo-fibrous tuberculosis.
5. Chronic fibro-caseous tuberculosis.
6. Chronic caseo-fibrous tuberculosis.
7. Chronic fibrous tuberculosis.
8. Atypical basal tuberculosis, without apical lesions.
9. Acute pleuritis, sero-fibrinous.
10. Chronic fibrous pleuritis.
11. Pleuritic effusion.
12. Caseous tuberculous pleuritis.

Four reports of the post mortem roentgenological examination of patients dying from pulmonary tuberculosis are here presented. The two reports which immediately follow describe the typical roentgenologic appearance of the lungs in patients dying with an acute miliary type of tuberculosis. One of these patients had a tuberculous focus in the scapula; the other had an accompanying pleuritic effusion.

Post mortem No. 1. J. D. S., colored, male. The bony thorax, trachea, aorta and heart appear normal. Moderate pleuritic effusion is present on the right side. General acute pleuritis, probably sero-fibrinous, over both lungs. Throughout the entire right and left lungs are innumerable minute tubercles, the individual tubercles being so small and so close together that the lung appears as if thickly salted with very fine granules. There is no definite fibrosis in either lung. Findings typical of an acute miliary type of tuberculosis. Mode of dissemination—hematogenous.

Post mortem No. 2. J. E. S., colored, male. The bony thorax is normal. There is a focus of tuberculous osteomyelitis in the body of the left scapula along its vertebral border, and also in the tip of the spine of the scapula. The trachea, aorta, heart, diaphragms and costo-diaphragmatic angles appear normal. Slight acute pleuritis is present over both lungs. The right upper lobe shows very slight bronchial tree density. Throughout both lungs there is a marked tuberculous infiltration. Some of the lesions are beginning to coalesce. On the right, at the level of the second interspace anteriorly, there is beginning degeneration of lung tissue. No fibrosis is noted in either lung.

The following report describes the findings in a rather typical patient of a fair sized group. This patient's lungs showed a chronic tuberculosis, with adhesive pleuritis, both apical and basal, pleuro-pericardial adhesions, and an acute superimposed tuberculosis throughout both lungs. In addition there was an acute pulmonitis throughout the right lung.

Post mortem No. 3. R. L. W., white, male. General retraction of the left thorax, most marked over the apex. *Right pleura:* A diffuse pleuritis is present over the entire right lung, uniform in density, apparently recent and active. This pleuritis is judged to be recent on account of its uniformity and the lack of secondary deformity of the thoracic wall. No irregularity of the diaphragm is present, and the angle is acute in form. *Left pleura:* Over the upper part of the left lung, from the apex to the level of the second rib anteriorly, third or fourth dorsal spine posteriorly, is a rather dense pleuritis, apparently chronic, evidently adhesive in type, shown by the retraction of the upper thoracic wall on this side, displacement of the trachea, aorta and heart to the left, and a generally thicker pleura. The left diaphragm is elevated, and a definite band-like adhesion is present at the dome, between the base of the lung and the pleura over the diaphragm. *Right lung:* The upper lobe in its midportion shows what appears to be slight old fibrosis. This is not, however, attended by definite chronic parenchymal lesions. Throughout the entire right lung are innumerable recent productive parenchymal lesions of the miliary type. Superimposed upon this productive process is an evident consolidation and congestion indicative of an acute pulmonitis. In the midportion of this lung are small areas of decreased density, poorly defined, due to recent degeneration. *Left lung:* The upper part of the left lung shows well-defined fibrosis, of the chronic type. This fibrosis extends, in the upper part of the upper lobe, to the pleural zone. A cavity, approximately 7 cm. in diameter, roughly round, with well-defined fibrous walls, is present in the apex. A smaller cavity, about 3 cm. in diameter, of the same character, is present at the level of the second interspace anteriorly. Other smaller, and varying sized cavities are scattered in the upper lobe above the level of the fifth rib anteriorly. Definite parenchymal lesions are present in both lobes of the left lung, more numerous in the upper lobe than in the lower. The lesions in the upper lobe appear older and more chronic than the lesions in the lower lobe. Throughout the left lung, in addition to the older lesions of the mixed type, there are more recent productive lesions similar to those present in the other lung.

Résumé: A chronic pulmonary tuberculosis in the left upper lobe, with multiple old cavi-

ties. The oldest lesions in point of time in either lung are in the upper lobe of the left lung. A recent acute tuberculosis throughout both lungs. An acute pulmonitis of the right lung. An old fibrous pleuritis, with adhesions, left. A recent bilateral serofibrinous pleuritis.

The following report presents the roentgenological findings in a patient with a chronic tuberculosis of the left lung. A superimposed syphilitic infection caused a breaking down of the protective fibrosis, extensive and widespread degeneration of lung tissue, and an acute disseminated tuberculosis. This report is likewise typical of many patients in this series.

Post mortem No. 4. S. D. L., white, male.

The trachea, aorta and heart are drawn to the left. The diaphragm and angle on the left are obscured. Marked pleuritis is present over the entire left lung, with evidence of pleuritic adhesions. *Right lung:* The upper lobe shows rather extensive cavitation from the apex to the level of the third rib anteriorly. The cavities have poorly defined walls, without evidence of material fibrosis. Throughout the right lung, in the portions not subject to cavitation, are numerous recent tubercles. Many of the parenchymal lesions are conglomerate. Fibrosis is negligible. *Left lung:* Extremely marked degeneration and cavity formation are present throughout the left lung from apex to base. The lung parenchyma is almost completely destroyed, only fibrous strands persisting. Fibrous trabeculations traverse the lower part of this cavity, and a small strand of tissue crosses the apical portion.

Résumé: A chronic pulmonary tuberculosis, with widespread degeneration and cavitation, breaking down of fibrosis, and an acute disseminated tuberculosis. Probable syphilitic infection superimposed on a chronic pulmonary tuberculosis.

The following statistical tables, eight in number, summarize the findings in this group of 100 patients examined by stereoscopic roentgenograms post mortem. All of the patients here reported were males. The average age fell in the third decade of life. The group was composed of active, retired and former soldiers and sailors. The patients in general came from a rather selected class, having been examined and accepted for general military or naval service, in most instances, prior to the onset of symptoms suggestive of a tuberculous infection.

TABLE I

GENERAL SUMMARY; NUMBER OF EXAMINATIONS; COLOR; SEX; CAUSE OF DEATH; INCIDENCE OF VARIOUS TYPES OF PULMONARY TUBERCULOSIS

Total number of patients examined roentgenologically post mortem		100
Patients showing tuberculous lesions in lungs		100
Patients with two distinct types of lesions in lungs		22
Males		100
Females		0
White		76
Colored		24
Unilateral tuberculous involvement of lungs		1
Patients dying of pulmonary tuberculosis with unilateral involvement		0
Patients dying of pulmonary tuberculosis with bilateral involvement		95
Deaths from tuberculosis or its complications		95
Deaths from other causes		5
Cardio-vascular disease	2	
Pneumonia, acute	1	
Pleuritic effusion	1	
Carcinoma of liver with lung metastases	1	
Acute miliary tuberculosis		23
White patients	17	
73 per cent of this type.		
Colored patients	6	
27 per cent of this type.		
Acute disseminated tuberculosis		50
White patients	37	
74 per cent of this type.		
Colored patients	13	
26 per cent of this type.		
Caseous tuberculous bronchial and lobar pneumonia		6
Chronic mixed fibro-caseous and caseo-fibrous tuberculosis		19
Chronic fibro-caseous tuberculosis		6
Chronic caseo-fibrous tuberculosis		5
Chronic fibrous tuberculosis		13
Tuberculosis with syphilis or streptococcus infection		29
Tuberculosis with massive degeneration		26
Tuberculosis with pneumothorax		16
Tuberculosis with pleuritic effusion		21
Tuberculosis with empyema		1
Caseous tuberculous pleuritis		2

TABLE II

INCIDENCE OF COMPLICATIONS OF PULMONARY TUBERCULOSIS, DEMONSTRATED ON POST MORTEM ROENTGENOGRAMS OF THE CHEST

Total patients examined post mortem by roentgenograms		100
Pleuritis, non-adhesive		20
Pleuritis with adhesions		77
Pleuro-pericardial adhesions		13
Pleuritis with effusion		11
Caseous pleuritis		2
Empyema (suppurative pleuritis)		2
Pyopneumothorax		16
Right	6	
Left	10	
Cavitation		83
Marked parenchymal degeneration		30
Acute pulmonitis (pneumonia)		6
Aortitis		4
Cardiac dilatation		16
Pericarditis with effusion		2
Tuberculosis of the dorsal spine		3
Tuberculosis of the scapula		1
Sarcoma of rib		1

TABLE III

INCIDENCE OF CAVITATION, TYPE, DEGREE AND LOCATION OF CAVITIES

Total patients examined		100
Patients with cavitation		83
Unilateral cavitation	24	
Bilateral cavitation	59	
Type of cavitation:		
Recent only		44
Chronic only		22
Both recent and chronic (old) cavities		17
Number of cavities:		
Single cavity		11
Multiple cavities		72
Degree of cavitation:		
Slight		12
Moderate		41
Marked or extensive		30
Number of lobes of lung involved by cavitation:		
One lobe		17
Two lobes		27
Three lobes		16
Four lobes		8
Five lobes		15
Lobar involvement:		
Right upper lobe		66
Right middle lobe		25
Right lower lobe		28
Left upper lobe		75
Left lower lobe		32

TABLE IV

INCIDENCE, DEGREE, STATE AND DISTRIBUTION OF FIBROSIS

Total patients examined		100
Patients showing definite pulmonary fibrosis		60
Patients without demonstrable pulmonary fibrosis		40
Analysis of patients with fibrosis in lungs:		
Well-developed fibrosis in both lungs		2
Moderate fibrosis in both lungs		17
Slight fibrosis in both lungs		8
Well-developed fibrosis in one lung, and slight fibrosis in opposite lung		1
Moderate fibrosis in one lung, and slight fibrosis in opposite lung		6
Moderate fibrosis in one lung, and no fibrosis in opposite lung		10
Slight fibrosis in one lung, and no fibrosis in opposite lung		16
Analysis of patients without fibrosis in lungs:		
Acute tuberculosis		33
Chronic tuberculosis		3
Combined acute and chronic tuberculosis		4
Unilateral fibrosis		26
Bilateral fibrosis		34

TABLE V

INCIDENCE, TYPE, EXTENT AND LOCATION OF PLEURITIS

Total patients examined		100
Patients presenting evidences of pleuritis		97
Acute pleuritis (sero-fibrinous type)		26
Chronic pleuritis		50
Both acute and chronic pleuritis		21
Unilateral pleuritis		4
Bilateral pleuritis		93
Pleuritic adhesions		77
Unilateral pleuritic adhesions		44
Apical	8	
Basal	18	
General	18	
Bilateral pleuritic adhesions		33
Both apices	5	
Both bases	5	
One apex and opposite base	3	
Both apices and one base	5	
Both bases and one apex	11	
General	4	
Obliterative general adhesive pleuritis		35
Unilateral	31	
Bilateral	4	
Pleuro-pericardial adhesions		13
Caseous pleuritis		2
Empyema		2
Pleuritis with effusion		11
Right	4	
Left	5	
Bilateral	2	

TABLE VI

PLEURITIC ADHESIONS. INCIDENCE OF VARIOUS EVIDENCES OF PLEURITIC ADHESIONS ON ROENTGENOLOGICAL STUDY

Total patients examined		100
Patients showing evidences of pleuritis		97
Patients presenting evidences of pleuritic adhesions		77
Primary evidences of adhesions		71
Irregularity of the diaphragm	71	
Obliterated or shallow angle	50	
Visible adhesive bands	12	
Secondary evidences of adhesions		55
Displacement of trachea	55	
Displacement of aorta	30	
Displacement of heart (not due to effusion or pneumothorax)	23	
Narrowing of rib interspaces or retraction of thorax	42	

TABLE VII

CARDIAC ABNORMALITY

Total patients examined		100
Normal sized heart		73
Large heart		16
Small heart		1
Size doubtful (obscured by pleuritis or lung density)		10
Displacement of heart		37
Displacement of heart to the right	20	
Displacement of heart to the left	17	
Displacement of heart due to pleuritic effusion or pneumothorax		14
Pericarditis with effusion		2

TABLE VIII

COMPARISON OF ROENTGENOLOGICAL AND PATHOLOGICAL DIAGNOSIS, PATIENTS 1 TO 73, THIS SERIES

Roentgenological diagnosis:	
Tuberculosis of lungs	49
Tuberculosis with syphilis	21
Tuberculosis and carcinoma	2
Tuberculosis and sarcoma (from rib)	1
Pathological diagnosis:	
Tuberculosis of lungs	44
Tuberculosis with syphilis	25
Tuberculosis; syphilis; diabetes	1
Healed tuberculosis; carcinoma; syphilis	1
Tuberculosis and carcinoma	1
Tuberculosis and sarcoma	1

TYPES OF PULMONARY TUBERCULOSIS

Acute Miliary Tuberculosis. Twenty-three patients in this series presented the acute miliary type of lesion only. Uni-

formly distributed lesions were present in both lungs. Fibrosis was absent in all of these patients. Acute pleuritis was uniformly present. Many of these patients died before cavities were demonstrable. The mode of dissemination in these patients was evidently hematogenous. Many patients in this type presented, clinically, evidences of meningitis and peritonitis. All of these cases were miliary tuberculosis from a pathological as well as from a roentgenological standpoint.

Acute Disseminated Pulmonary Tuberculosis. Fifty patients presented an acute disseminated type of tuberculous pulmonary lesion, in many respects resembling the miliary type. The productive lesions were widespread. Not all of the lesions, however, appeared to be of the same age, as is usually the case in the true miliary type. Some of the lesions were conglomerate, others more or less discrete. The absence of a fibrotic reaction argued for an acute process. Some of these patients had other types of lesions, older in point of time, in the lungs. The mode of dissemination in this type is probably by lymphogenous extension, aspiration and then rapid dissemination by hematogenous methods.

Caseous Tuberculous Bronchial and Lobar Pneumonia. Six patients were placed in this group with respect to their pulmonary lesions. Extensive bilateral involvement was present in all. Patchy or lobar areas of consolidation, with caseation, were also present. A marked exudative reaction was present. Cavitation of recent origin, often rather extensive, without material fibrosis, caseation, consolidation, and a generally rapidly advancing process characterized this type.

Mixed Fibro-caseous and Caseo-fibrous Pulmonary Tuberculosis. Nineteen patients presented this general type of lesion. Many of these patients showed more or less nodose lesions, with some evidence of fibrosis. Fibrosis and caseation appeared to be of about equal importance in this type. Less exudative and inflammatory reaction was present than in the preceding type. The mode of dissemination in this type was apparently by combined aspiration and lymphogenous dissemination.

Fibro-caseous Pulmonary Tuberculosis. Six patients presented a fibro-caseous type of lesions. Rather extensive involvement was present, as in the mixed type, but the caseation appeared slightly more prominent in the roentgenological picture than the fibrosis. Some cavitation and caseation, with modifying fibrosis, were uniformly present.

Caseo-fibrous Pulmonary Tuberculosis. Five patients presented this type of pulmonary lesion. This type of lesion was found in several patients who presented an acutely disseminated recent process in both lungs. The older lesions presented definite evidences of chronicity, with definite fibrosis, and only slight or modifying caseation. The breaking down of protective barriers of fibrosis by a superimposed streptococcus or syphilitic infection predisposed to a widespread acute process, by all methods of dissemination.

Chronic Fibrous Pulmonary Tuberculosis. No patients in this series died from a chronic fibrous tuberculosis. Thirteen patients presented definite chronic fibrous type of lesion somewhere in the lungs. Several patients with this type of lesion present also showed an acute disseminated tuberculosis. The only patient in this series who showed only unilateral tuberculous lesions was placed in the chronic fibrous type. This patient died with a carcinoma of the liver and pulmonary metastases.

Twenty-nine patients presented a type of lung degeneration, very extensive, apparently rapidly progressive and not limited or stopped by fibrous barriers. This type of patient showed, on pathological examination, definite evidences of a combined tuberculous and syphilitic process in the lungs. We soon came to recognize this type roentgenologically with a considerable degree of accuracy.

A pyopneumothorax occurred in 16 patients. Six of these were on the right side and 10 on the left. The majority of the pneumothoraces were of the spontaneous type. There were no distinguishing features, on roentgen-ray examination, by which the spontaneous could be differentiated from the artificial type.

Pleuritic effusion was present in 11

patients. Four effusions were on the right side, 5 on the left side, and 2 were bilateral.

Two patients presented evidences of a chronic empyema, with drainage tubes into the thoracic cavity.

Marked pleural thickening, with considerable separation of the parietal and visceral pleurae, was present in 2 patients. The dense pleural mass proved pathologically to be a caseous pleuritis.

No patient dying from pulmonary tuberculosis showed unilateral lesions. Practically every patient presented lesions throughout all lobes of both lungs.

UNUSUAL FINDINGS NOT INCLUDED IN TABLES

Patient No. 89. This patient presented prac-tically complete destruction of the left lung, with only small tags of necrotic tissue hanging from the adherent visceral pleura. Extensive involvement, with extensive cavitation, was also present in the opposite lung.

Patient No. 100. In this patient the entire left lung was destroyed by cavitation. A fatal hemorrhage occurred into this cavity, without hemoptysis.

Patient No. 8. This patient presented, in addition to a chronic tuberculosis, a gumma of the base of the left lung, a localized syphilitic fibrosis and an infiltration of the diaphragm.

Patient No. 15. The roentgenograms of this patient showed no abnormal pleuritic density. Definite evidences of bilateral pleuritic adhesions were present. Necropsy revealed a very thick, tough pleura, in some places over one-fourth inch in thickness, over both lungs. The roentgenologic findings in this patient proved the truth of the statement made by the pathologist at that time, that the radiodensity of pleuritis depends largely upon the moisture content of the pleuritis. A dry pleura does not necessarily cast an abnormal density on the film, while a very thin layer of pleural fluid over the lung may give a marked density on the roentgenogram.

SUMMARY AND CONCLUSIONS

(1) One hundred patients, dying in a hospital devoted to the care of the tuberculous, have been examined post mortem by stereoscopic roentgenograms of the chest.

(2) Certain tables have been worked out in the analysis of these roentgenograms, showing the incidence of various types of tuberculosis in these patients, with data concerning the pleural complications, the condition of the heart, cavitation and fibrosis.

(3) A high percentage of acute miliary tuberculosis was present in this series of deaths from tuberculosis; 23 per cent of the deaths were due to typical acute miliary tuberculosis.

(4) The percentage occurrence of acute miliary tuberculosis in the young adult colored male was practically identical with the occurrence in the young adult white male.

(5) An astonishing degree of cavitation in the lungs is compatible with life and, indeed, without hemorrhage.

(6) Pleuritic adhesions are found with great frequency in all types of pulmonary tuberculosis.

(7) Roentgenological examination can separate and classify tuberculous patients into fairly distinct types.

(8) Approximately 25 per cent of the patients in this series presented, both from a roentgenological and a pathological standpoint, evidences of a combined tuberculous and syphilitic process.

(9) The occurrence of a syphilitic infection in a patient suffering with a chronic pulmonary tuberculosis often results in a breaking down of protective fibrosis and a widespread dissemination of an acute tuberculous process.

(10) The radiodensity of pleuritis appears to depend largely upon the moisture content.

(11) The avoidance of secondary infections, particularly syphilitic and streptococcic infections, is of vital importance to the patient suffering with pulmonary tuberculosis in any form.

(12) Valuable information tending to improve one's concept of the pathology of pulmonary tuberculosis can be obtained through study of post mortem roentgenograms of the chest.

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ROENTGENOGRAPHIC ESTIMATION OF CONCENTRATION OF TETRAIODOPHENOLPHTHALEIN IN THE GALL-BLADDER

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ROENTGENOGRAPHIC visualization of the gall-bladder by the method of Graham and Cole depends not only on the patency of the ducts but also on the capacity of the gall-bladder mucosa to concentrate the bile. We actually see all degrees of concentration. We suppose that there is some relation between degree of concentration and degree of gall-bladder disease or injury. If we are to learn something about the clinical correlation of the disease with the response to the test, we must seek a quantitative expression for the concentration attained. It must be obvious that an estimation of actual percentage of dye in the gall-bladder bile will be more satisfactory than an arbitrary "one plus" or "three plus."

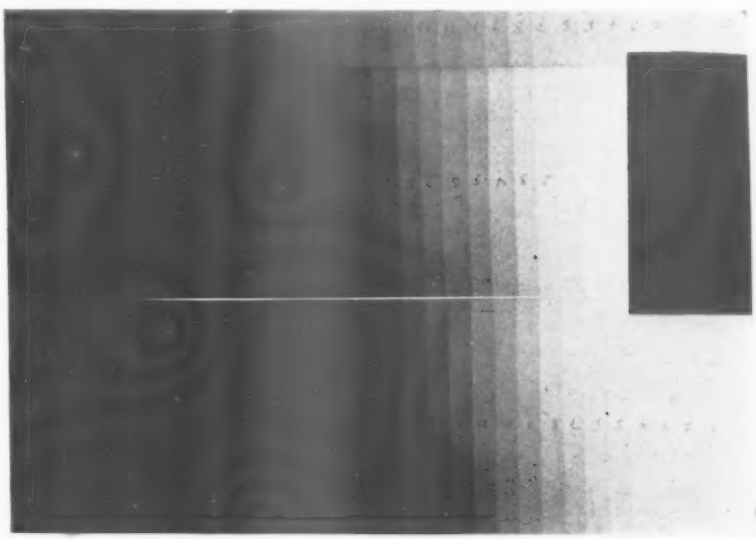

FIG. 1. Effect of development and fogging on contrast. All three films were exposed the same. Each step received 20 per cent heavier exposure than the one on its left. The top film was developed half as long as the middle one. Observe that the gradation is identical in the two—the size of the interval is not changed by variation in development.

The bottom film was fogged by a small roentgen-ray exposure all over it. Observe that the gradation is flattened—the fog makes the interval from one step to the next appear much less, especially toward the lighter end.

THEORY

If we always use the same roentgen-ray wave length, then a given concentration of tetraiodophenolphthalein will always absorb a certain unchanging percentage of roentgen rays for a given depth. This percentage absorption will be independent of the total amount of roentgen rays—i.e., will be the same for a heavy exposure as for a light one. Within what limitations can this percentage of absorption be estimated from roentgenograms?

SENSIBILITY

The eye can perceive differences of opacity corresponding to 10 per cent difference in exposure in the middle range, but in thin films or very dense ones the sensibility diminishes to about 20 per cent. This is not great precision, but it is good enough for clinical purposes. To attain even this, however, it is necessary to cut through the center of the shadow to be estimated so that it can be laid close alongside the standard, and then to examine an

equal field of each. I have found a gray card with a 6 mm. round hole in the middle a good way to limit the field, the line of separation between unknown and standard lying on a diameter of the hole.

DEVELOPMENT

Within reasonable limits under-development or over-development does not alter the percentage difference in roentgen-ray exposure that will be inferred from comparison of film opacities (see Fig. 1).

FOG AND SCATTERING

Even a little fog diminishes the contrast and so makes the estimation inaccurate (see Fig. 1). Chemical and light fog can be avoided by careful darkroom technique. Roentgen-ray fog from scattering in the patient's body can be stopped by the use of the Bucky diaphragm supplemented by a cone of reasonable diameter. With these precautions the contrast remains independent of the patient's size (see Fig. 2).

METHOD A

It is found that a layer of 2 per cent tetraiodo solution 1 cm. thick absorbs about 16 per cent more roentgen rays than pure water. The next 1 cm. thickness (or the addition of another 2 per cent, making 4 per cent, without changing the thickness) will, then, absorb 16 per cent of what is left, and so on.

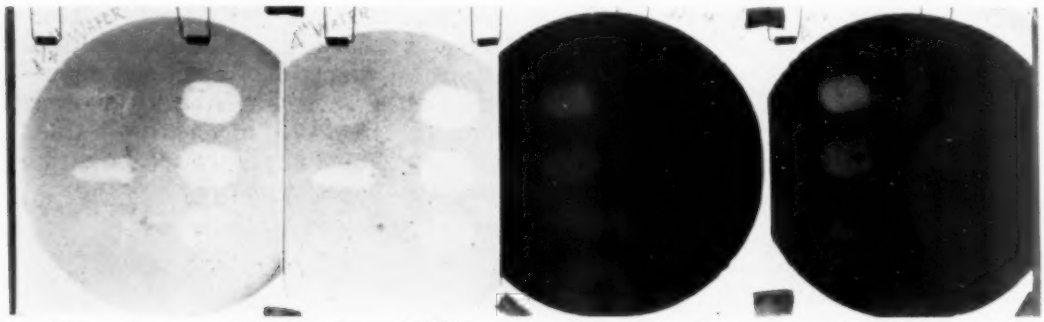

Fig. 2. Illustrating contrast independent of thickness of patient. The phantom was filled with water to 1¼ inches and then to 4 inches in depth. By light or heavy exposure the depth of water is seen not to influence the contrast. This is true only when scattered rays are stopped by the use of the Bucky diaphragm.

A scale of opacities is therefore prepared by exposing a roentgen film in successive steps of convenient width, each step receiving 16 per cent less exposure than the next one.

The gall-bladder film is cut through the center of the gall-bladder shadow which is

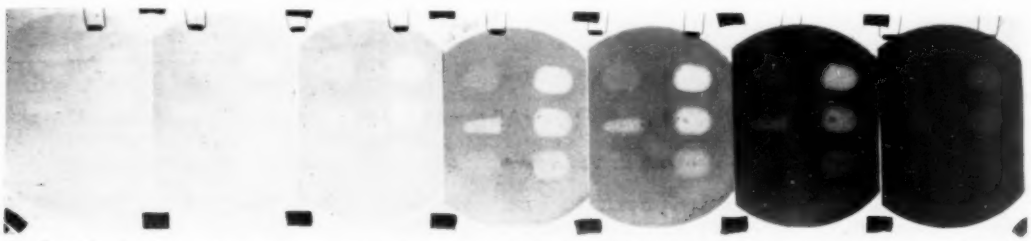

Fig. 3. Standards. For estimating concentration of tetraiodophenolphthalein in the gall-bladder from the density of its shadow in the roentgenogram. The 3 cm. rubber bags contain 0.25, 0.5, 1, 2, and 3 per cent of dye, respectively. The 1.5 cm. bag contains 2 per cent of dye. All are immersed in water.

then matched to one of the steps of the scale (in the way outlined in the paragraph on *sensibility*). In the same way a match is found for the region just outside the gall-bladder. If these are adjacent on the scale, then one sees that the dye in the gall-bladder has absorbed 16 per cent of the roentgen rays. If the layer of bile were only 1 cm. thick this would mean a concentra-

tion of 2 per cent. But if the gall-bladder shadow is of average size—say 3 cm.—one infers that the diameter from front to back is also about 3 cm. This means that the concentration of dye is not 2 per cent but ⅔ per cent. Take another example:

Gall-bladder shadow matches tint 6; surrounding field matches tint 9. That is 3 steps apart and each step means 2 per cent dye for a 1 cm. layer. So we have absorption equivalent to 6 per cent dye in a 1 cm. layer. But if this gall-bladder is, say, 3.5 cm. in diameter, the concentration is actually: $\frac{1}{3.5} \times 6\% = 1.7\%$.

In practice, unfortunately, the gall-bladder shadow is laid upon a field which is anything but even in density. Liver and kidney shadows and gas-filled colon may produce many scale divisions difference in opacity from point to point. The result is that one concludes 1 per cent concentration when he compares the gall-bladder with its field laterally and perhaps 2.5 per cent when one considers the field mesially.

METHOD B

(Most Practical)

I soon began to feel that my judgment of the whole film was better than my point to point measurement of it. Acting on this feeling I am no longer using the scale of opacities, but have prepared a scale of gross comparison standards. This consists of seven 8 × 10 films of a test object, an aluminum vessel containing rubber bags filled with tetraiodo solutions of 0.25, 0.5, 1, 2, and 3 per cent, stuck to the bottom with paraffin. The vessel was filled 4 inches deep with water and exposures made with Bucky diaphragm, double screens, 4 inch spark gap, radiator tube. It is important to imitate one's routine gall-bladder technique in all particulars. *The use of the Bucky diaphragm for patients as well as standards is imperative.* The exposures varied from very light to very dark by 50 per cent steps (see Fig. 3). One of these standards is chosen which nearly matches

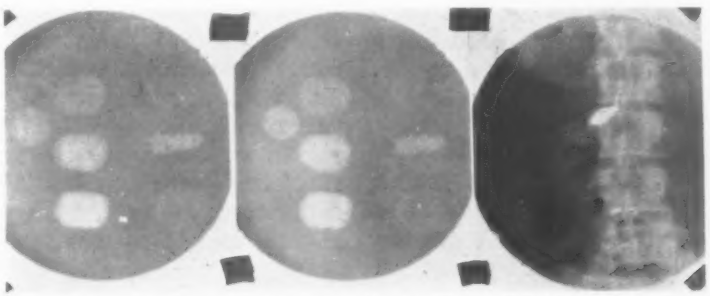

Fig. 4. Standards of density upon the cassette and within the stomach.

in general density the film to be reported on. Then it will appear that the visualized gall-bladder looks, on the whole, about like one or another of the bags. The known concentration in the bag is taken as a satisfactory approximation to the concentration in the patient's gall-bladder. A correction is, of course, necessary for the size of the gall-bladder if it differs much from the size of the test object (the rubber bags are 3 cm. in diameter). For a weak solution will cast as dense a shadow as a strong one if only it exists in a layer of sufficiently greater thickness.

EXAMPLE OF USE OF THE METHOD

At the regular time after administration of tetraiodophenolphthalein to the patient, make a film of his gall-bladder region, using 4 inch spark gap, Bucky diaphragm, double screens and whatever exposure time is necessary to produce a good film.

It is found that the gall-bladder has cast a shadow. Its surroundings appear on the whole about as dark as the ground of film No. 5 of the scale (Fig. 3). Holding this alongside the patient's film, judge which one of the bags it is that looks most like the gall-bladder (in density). If the gall-bladder matches the 2 per cent bag and is not very different from it in size, it may

be concluded that the dye has reached a concentration of 2 per cent in the patient's gall-bladder. I should call that good function.

As a rough test of the dependability of this method, I persuaded one of our medical students to swallow a rubber bag on the end of a Rehfuss tube. Unfortunately this did not pass the pylorus as originally intended. The bag was filled with varying concentrations of tetraiodo in water. Estimation by Method B corresponded fairly well with the facts. I am indebted to Dr. L. B. Dickey for this suggestion.

METHOD C

It is inconvenient to have to search through a number of standards to find one of the right ground density. A standard could be laid on the cassette or against the patient's belly to show on the film for comparison with the gall-bladder shadow. Tin suggested itself because of the nearness of its atomic weight to that of iodin. A disc of tinfoil (commercial, 10,000 sq. in. per lb.) looked about like the 1 per cent bag, or a little denser, but measured by Method A about equal to the center of the 0.5 per cent bag. The reason for the discrepancy is that the tin has full density right up to the margin, giving great contrast, whereas the shadow of the bag (or of the gall-bladder) falls off toward the edge because of its curved shape. So a disc of red rubber gasket was buffed off around the edge until its shape approached that of a hemiellipsoid. This was more satisfactory.

Method A confirmed the gross impression that its absorption lay midway between that of the 1 per cent and the 2 per cent bags. In Figure 4, the rubber disc lies on the cassette in the second film and immersed in the water in the phantom in the first film. The mimicry is more convincing in the latter case, though the actual density of the middle of its shadow is not very different. The third film shows the disc near the top of the cassette and a bag filled with 2 per cent tetraiodo in the stomach. One would judge the bag to be less dense than the disc—an error due I believe to the difference in background. This is a difficulty I do not see how to avoid. It leads me to prefer Method B.

By any method there is a necessary correction for the presumptive anteroposterior diameter of the gall-bladder, as discussed more fully under Method A. In using Method B (or C) this must be applied with great caution because of the difference of gradation at the margin. The smaller bag has the steeper marginal gradation, leading to an illusion of greater contrast. The small bag in the standard films is filled with 2 per cent solution. Being half as thick it should look half as dense. However it actually appears nearly as dense as the full sized 2 per cent bag. Measurement by Method A shows this to be truly an illusion, for the centers of the full sized 1 per cent bag and half sized 2 per cent bag measure the same opacity.

We have been using Method B on all tetraiodo films in this laboratory since March 1, 1926. It is convenient and while it is not highly accurate nor by any means precise, yet it has, on the whole, proved satisfactory. Its real value can be judged only after we have accumulated sufficient data to estimate how good is the correlation with clinical, operative and pathological experience.

SUMMARY

A method is described for estimating the percentage concentration of tetraiodophenolphthalein in the gall-bladder after oral or intravenous administration.

The method depends on comparison of the roentgenograms with known standards.

Accuracy, precision and possible sources of error are discussed.

The author believes the method clinically useful.

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TRAUMATIC PNEUMOVENTRICLE OF THE CEREBRUM

REPORT OF TWO CASES

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THE term pneumoventricle is used to denote the presence of air within the ventricles of the brain. The condition follows injury and is associated with fracture of the skull. Other terms such as pneumocranium, pneumocephalus, intracranial aerocele, and traumatic aerocele are used. Grant takes exception to the term "pneumocranium." He states: "It has no definite meaning" and prefers to use the term "intracranial aerocele" since, he argues, "aerocele denotes a cavity or tumor containing air." Dandy uses the term "pneumocephalus," subdividing this condition into four varieties, arachnoid, subdural, intracerebral and intraventricular pneumocephalus and our cases would therefore represent Dandy's fourth variety of pneumocephalus. It can readily be seen that where the injury is such as to allow air to enter the ventricles of the brain thereby filling them with air, the term aerocele cannot reasonably be used since the condition is not one in which a cavity or tumor is found. Teachenor uses the term "pneumoventricle." Since the case he describes is almost identical with the two here presented we prefer to follow his nomenclature adding to it the word traumatic.

Dandy has recently reviewed the entire subject of pneumocephalus so thoroughly that it would be presumption to do anything else but refer the reader to his article. He has been able to compile from the literature 25 cases in all, adding 3 which came under his observation. Six cases presented the condition of pneumoventricle. While additional cases are being reported as time goes on, still the condition remains one which is infrequently met with.

CASE REPORTS

CASE 1. C. D., male, aged sixty-three, was admitted on the service of Dr. Kirby Collier on August 13, 1921 at 3:30 P.M. While acting as station agent in a town eighteen miles distant he was caught between a falling box and the platform of the freight station in such a manner as to injure his head. He was brought in by automobile a distance of approximately 20 miles. He apparently did not suffer from the effects of the trip and arrived in a conscious state. He was bleeding from his right ear and both nostrils. Marked ecchymosis was present around both eyes. His temperature was normal and his pulse rate was 85. His blood pressure was 130/70. A roentgen examination made of the skull within an hour after admission showed the condition which is observed in Figure 1. A fracture was demonstrated which involved the sphenoid bone anterior to the sella turcica. The clinoid processes were ill defined and showed evidence of involvement. No other evidence of fracture was outlined. The lateral ventricles of the brain were shown to be distended and filled with air. Irregular areas of lessened density (air) could be seen scattered through the skull region. A roentgenogram made in the anteroposterior plane showed both lateral ventricles evenly distended and normal in their outlines. There was no displacement of either ventricle. In other words, they bore a normal relationship to each other.

The patient was put to bed and treated expectantly. The pulse varied but slightly during the first two weeks following injury but at the beginning of the third week it hovered around 120 times per minute. The pulse pressure which was recorded several times a day gradually went down to 110/64 and then to 100/66 and varied or fluctuated considerably up to the time of his death. The temperature remained practically normal until a short time before death when it rose to 102.6°F. on the twenty-fifth day after admission. The cerebrospinal fluid, after removal from the spinal canal, was examined on several occasions, a high white cell count and many red cells being observed. The first examination made on August 27, 1921 showed a white cell count of 565 per c.m. This varied but little. Upon culturing the spinal fluid no growth was obtained. The patient suffered mostly from a severe pain in his head which was relieved only by means of opiates. A cerebrospinal rhinorrhea was present. On August 29, the

sixteenth day after admission, another roentgen examination of the skull was made. No air was demonstrated within the ventricles but a few scattered areas of lessened density were still outlined within the cranial cavity evidently in the subarachnoid space. On the twenty-second day after admission the patient became very restless. His temperature rose to 104°F. The pulse rate was 28 and the pulse pressure registered 150/90. After a spinal tap which was performed on this same day the pulse pressure went down to 125/70 but there was no improvement in the patient's general condition. He expired on the following day, the twenty-third day after admission.

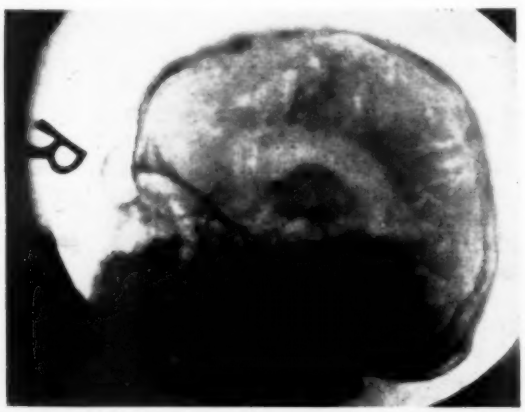

Fig. 1. Case 1. Traumatic pneumoventricle of the cerebrum showing air in the ventricles. Lateral view.

Necropsy Findings; Head: There is no external evidence of injury to the skull. There are no hemorrhages or ecchymoses found on removing the scalp. On removal of the skull cap the meninges are observed to be somewhat congested and a small degree of edema is present behind the pia mater. The dura mater is firmly adherent to the bones of the skull and is stripped from the bone only with difficulty. There is no purulent exudate present although some of the fluid appears cloudy. On lifting the brain from the anterior fossa a considerable amount of cerebrospinal fluid is seen to flow from the brain at an opening near the optic tract on each side. A large collection of cloudy fluid is found beneath the pia mater covering the pons and medulla and extending down the cord as far as can be seen.

Brain: On opening the lateral ventricles each ventricle is found to contain about 25 c.c. of slightly blood-stained fluid and clot the size of an almond. The third ventricle is distended with a larger mass of clotted blood. The choroid plexus is pale. The velum interpositum appears unusually thick. The clots are not fresh, and drawing on the clots in the third ventricle moves all the other clots. These clots float in the fluid filling the ventricle. Except for a marked edema the cerebellum is normal. The fourth ventricle is distended, this distention being produced evidently by the presence of a large clot. The clot extends upward from the aqueduct of Sylvius largely closing it. At the base of the skull the dura mater is unusually adherent to the bones. In the region of the ethmoids there is present a small amount of extradural hemorrhage. Upon removal of the dura a fracture is found beginning at the left orbital plate of the frontal bone and extending backward through the ethmoid bone to the body of the sphenoid and around this to the foramen lacerum medium. From this it extends into the petrous portion of the temporal bone. In the ethmoid the fracture is comminuted. The fragments are easily lifted and instruments can be inserted into the nasal cavity. The sella turcica is not encroached upon and the pituitary is negative. Topographically the most serious part of the fracture of the base of the skull is that which corresponds to the floor of the lower and anterior cavity of the third ventricle in the region of the optic recess near to the conical depression of the infundibulum. Microscopical examination of the medulla and the cord is negative except for the clots which show beginning organization. Optic thalamus and hippocampus major negative. Cerebrum negative. The cord presents a small amount of calcification. Anatomical diagnosis: Fracture of the ethmoid, sphenoid and tem-

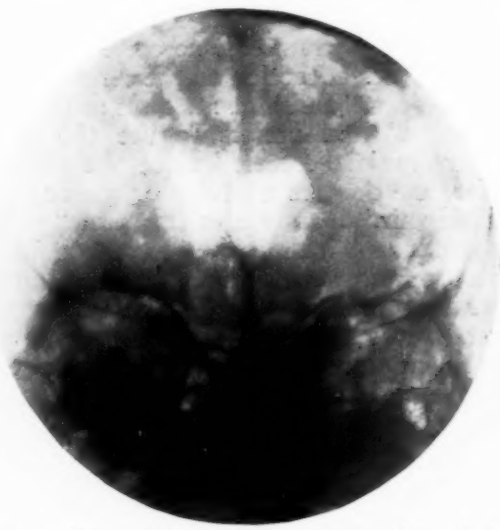

Fig. 2. Case 1. Traumatic pneumoventricle of the cerebrum showing air in the ventricles. Postero-anterior view.

poral bones connecting the nasal and cranial cavities. The position of the laceration in the dura is evidently not disclosed. It probably followed closely along the line of fracture.

It is difficult to believe that operation would have been of any avail in this case.

Case II. This case came under observation only recently. (He was a patient of Dr. Thomas Jameson to whose kindness I am indebted for the privilege of reporting the case.) A man, aged twenty-eight, was brought to the Highland Hospital in the ambulance presenting the following history. He is an engineer and upon attempting to adjust a bolt in a steam shovel while in an excavation a bank of earth on the side wall of the trench caved in, pinning him to the opposite wall. Something struck the side of his head. With considerable heroic effort he was dug out and removed to the hospital in an unconscious condition. On occasion, by strong stimulation, he could be aroused. He was bleeding from both ears and nostrils. The pupils were dilated and unequal and marked contusions were present around both eyes. The pulse pressure at this time was 118/60. The pulse rate was 66 to the minute and of good quality. His general condition appeared quite favorable. A roentgen examination made of his skull shortly after his admission (within two hours) showed the presence of multiple fractures, one main line of fracture extending from the anterior wall of the frontal sinus close to the floor extending upward and backward so as to involve a good part of the frontal bone on the left side. Another line of fracture was observed to involve the posterior sphenoidal region. Another fracture area was demonstrated in the region of the sella turcica. The normal outline of the sella could not be demonstrated. The posterior suture lines particularly around the temporal bone are abnormally prominent showing the presence of a moderate degree of separation of the bones in this region. A small amount of air was present in both lateral ventricles, so that they were only partially filled. There was no displacement of either ventricle, both ventricles being demonstrated in the middle portion of the skull region as one observes them in the anteroposterior plane.

On the second day following admission serous drainage, evidently cerebrospinal fluid, was observed escaping from the left ear. An examination of his ears made by Dr. A. V. Walker revealed the following: He shows defective hearing in both ears but mainly in the left one. This is ascribed to defect in the air conducting apparatus rather than the nerve mechanism. Both drums are badly retracted and adherent. They are congested and have no lustre. Practically no motility is observed in either drum head. An examination of his eyes made by Dr. W. E. Munroe at a later date revealed the following: The left eye is totally blind. This is due apparently to optic atrophy. The pupil is dilated and fixed, this being due

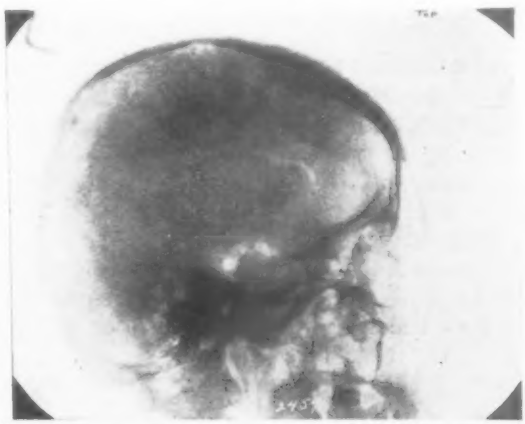

Fig. 3. Case I. Roentgenogram made on the sixteenth day following admission, showing almost complete absorption of the air.

Fig. 4. Case II. Roentgenogram showing air in the ventricles as observed in the anteroposterior plane.

evidently to the blindness and also to paralysis of the oculo-motor nerve. The injury to the optic nerve may be considered as being anterior to the optic chiasm as the temporal field of the right eye is intact. The eyeball is divergent and the upper lid droops, this being due to a paralysis of the third cranial nerve. The right eye is apparently normal. There is present an inability to close this eye owing to a partial facial palsy.

There developed a paralysis of the facial muscles on the right side with inability to close the right eye. The eye itself moved freely in all directions, the pupil responding to light

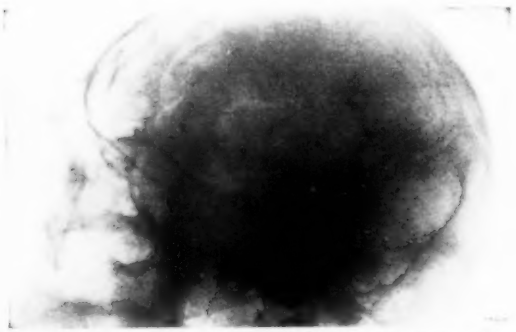

Fig. 5. Case 11. Shows several lines of fracture with a small amount of air in the lateral ventricles.

and accommodation. The sensory nerves in the superficial structures around the eye were apparently not involved since there was no loss of sensation. On the left side, there was present ptosis of the upper eyelid. The eye remained totally blind the pupil being dilated and fixed. The eyeball did not move in any direction except toward the outer side to a slight degree. Here there was evidently present paralysis of the oculo-motor nerve, the optic nerve and the opthalmic division of the fifth nerve.

This patient was treated expectantly, as in the previous case, no surgery being resorted to and he had a stormy recovery. On the nineteenth day after admission he showed evidence of respiratory involvement. A roentgen examination made of the chest at this time shows the presence of a considerable degree of haziness in the left base, such as one observes where pneumonia is present. Clinically this patient developed a pneumonia from which he gradually recovered. On the fifty-ninth day after admission he complained of pain in the left inguinal region and numbness of the leg. On the following day enlargement of the leg and thigh together with a definite edema developed, a note on his chart indicating that he had a thrombophlebitis. From this he also gradually recovered so that when he left the hospital the condition of his leg was markedly improved.

He was discharged on October 3, 1926, eighty-eight days after admission. The following notes were made at this time: "He is unsteady on his legs and reels toward the right side. His left eye is totally blind. His hearing is greatly impaired, the left ear markedly so. There is present marked improvement in the facial palsy, the third nerve showing a rapid return to normal function. He can now open and close his left eye quite well. The right eyelid can be partially lowered. There is still present some paralysis of the 7th nerve. He has a slight edema of the left leg."

The possible route by which it is assumed air gains admission to the ventricles following fracture is of interest. Teachenor, in speaking of his case, gives the following explanation. As the cerebrospinal fluid came from the right ear it is assumed that the air gained entrance by the same route. Fractures in this region tend to crowd the floor of the middle cranial fossa to the floor of the sella turcica. The floor of the third ventricle lies in this region. The floor of the third ventricle in the post-chiasmal region and about the tuber cinereum is very thin and the infundibular process of the third ventricle presses well into the pituitary stalk. A fracture in this region with a sudden displacement of the brain placing these tissues under tension might easily lacerate the third ventricle and permit an egress of ventricular fluid and an ingress of air. The air would then readily pass through the foramen of Monroe into the lateral ventricle.

Dandy does not quite agree with this explanation. In referring to Teachenor's case he says: "Although Teachenor makes the interesting assumption that the air might have entered the ventricles through a tear in the floor of the third ventricle I should be more inclined to believe it entered through the normal channels—the foramina of Luschka and Magendie. This will always be expected when the air is in sufficient quantity in the subarachnoid space." It is by means of these three openings that the system of ventricular cavities is brought into communication with the subarachnoid lymph space, and air in the subarachnoid space, when it is present in sufficient amount and under great

enough pressure, could readily displace the ventricular fluid and fill the ventricles with air. It would seem, therefore, that Dandy's explanation is most probably the correct one.

Case I showed a fracture of the ethmoid, sphenoid and temporal bones. Instead of the air gaining entrance into the cranial cavity by means of the auditory canal as in Teachenor's case, it seems logical to believe that most of it probably entered by means of the nasal cavity and ethmoid cells and then filled the subarachnoid space. Why did not the roentgenograms of Case I show more evidence of fracture? It is my feeling that the blotchy appearance produced by the irregular distribution of air in the subarachnoid space is greatly responsible for it. In Case II where air was demonstrated in the ventricles only, we had no difficulty in observing several areas distinctly denoting the presence of fracture. No evidence indicating marked injuries to the brain was demonstrated at necropsy. No evidence of laceration was found. One of our cases presented the condition of otorrhea and yet a similar end result, namely, pneumoventricle, was produced in both instances. It is interesting to note that in Teachenor's case, as in our second case, there remained partial paralysis of the seventh cranial nerve and complete paralysis of the auditory portion of the eighth nerve, although it is, as yet, too soon to state what the permanent result in our second case will be.

SUMMARY

1. Two cases of traumatic pneumoventricle of the cerebrum are reported, with a mortality rate of 50 per cent.

2. The condition follows fracture of the skull where the fracture is in such a location as to permit the entrance of air into the cranial cavity.

3. The most probable route by which air gains entrance into the ventricles of the brain is by means of the subarachnoid space.

4. The presence of a discharge of cerebrospinal fluid either through the ears or nose should make one suspect the presence of pneumoventricle.

5. The absolute diagnosis is made by the roentgen ray.

6. The dural tear which is, no doubt, present may be difficult to locate, should surgery be resorted to.

7. Patients with this condition may recover if treated expectantly. Evidences of nerve injury practically always remain.

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CHONDROMA OF THE VERTEBRAE
REPORT OF CASE

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OF primary growths in the vertebrae, sarcoma is the most common, carcinoma being the most common secondary growth met with. Other forms of primary growth are very rare. Among those found are hydatid cysts, exostoses, and chondromas. Chondromas of the spine present the same characteristics as chondromas in any other part of the body and are interesting largely because of their rarity. A most interesting example of chondroma has recently been examined by us and at this time I shall give a brief survey of the literature on the subject with a report of this case.

Chondromas are tumors composed of cartilage. They may arise from any bone or tissue containing cartilage and occasionally in tissue normally free from cartilage. The long bones are involved most frequently, the growth appearing near the ends of the bones, near, but not in, the epiphyseal line. The phalanges are very often involved. Chondromas are frequently multiple, and when arising from the pelvic bones or scapulae may attain a very great size.

McFarland's classification of cartilaginous new growths is as follows:

I. *Chondromatoids.*

1. *Ecchondroses.* These are cartilaginous outgrowths from the edges of the articular cartilages, passing through the capsular ligaments. They are commonly multiple and small. They seem to result from chronic irritation, and are common in rickets.

2. "*Joint mice*" and "*rice bodies*" are intra-articular cartilaginous formations varying in size, according to the size of the joint, from rice grains to hazel nuts. They are formed through chondrification of the villi of the synovial fringes, supposedly as the result of irritation.

II. *Chondroma.*

1. *Enchondroma.* These usually arise from vestiges of embryonal cartilage retained at the junctions of the shafts and epiphyses of the long bones, or about the ribs, scapulae, or pelvis. They may grow from the endosteum and occur singly or multiply in the medullary cavity.

2. *Ecchondroma.* These are bony outgrowths from pre-existing cartilage and occur in the larynx, in the trachea, or from the costal cartilages.

3. *Osteoid chondroma.* This tumor grows from the periosteum of the long bones, and is a peculiarly mixed structure consisting first of dense fibrillar tissue of the periosteum, which becomes first chondrified, then penetrated by trabeculae of ossein, and later tends to ossification.

4. *Chondroma myxomatodes.* A chondroma with myxomatous change.

III. *Chordoma.*

This tumor is described in the section upon the "Congenital Conditions of Surgical Interest," and was first named by H. Müller "ecchondrosis physalifora."

The multiple character of certain chondromas has been a striking feature, and in some cases nearly every bone in the body has been affected. In the notable case reported by von Recklinghausen the hands, feet, knee, elbow, and ribs were the seat of very numerous chondromas.

The chondroma may occur on the surface of a bone or may be central and produce an expansive type of growth of low density. Roentgenographically it may be impossible to differentiate the central type of chondroma from a bone cyst. Chondromas may be found in the testicles, mammary glands, parotid gland, lungs, cornea, fascia, and mucous membrane of the trachea.

Chondroma produces a hard, rounded, lobulated tumor which often reaches large dimensions. The lobulated structure is due to the expansive growth as a result of which the surrounding structures are pressed aside. In the very largest, masses may be formed composed of convolutions resembling the convolutions of the brain.

As in normal cartilage, few or no blood vessels are to be found in the substance of these tumors. This would seem to be the explanation of the lobulated character of the larger growths. Bands of connective tissue containing vessels divide the mass of the tumor and carry the vessels which afford nourishment. Growth occurs at the periphery, along the zone of the perichondrium. Where the growth is at all large there is a peculiar liability for the deeper cartilage to be replaced by true bony tissues (osteo-enchondroma); or, without the formation of true bone, there may be extensive calcareous infiltration. In the large enchondromas, from the increasing lack of nourishment of the central parts, as the tumor develops at the periphery, there may be a central degeneration and necrosis, the cells showing fatty degeneration, the interstitial substances undergoing liquefaction. If the tumor projects beneath the skin, and, through ulceration, the necrotic center comes to communicate with the exterior, a fistulous track is formed, which shows no signs of healing. The atonic character of the process is peculiarly apt to favor general sepsis.

The structure of chondromas reproduces that of various normal types of cartilage, chiefly the hyaline variety. Ranvier classified chondromas, according to their structure, in four groups: (1) A single lobe of hyaline cartilage; (2) several lobules of hyaline cartilage separated by fibrocartilage; (3) fetal cartilage, and (4) cartilage with stellate cells. The cells may be more or less numerous than in normal cartilage. They vary greatly in size and usually lack the orderly arrangement into groups of cells with opposed surfaces flattened. Peculiar vacuoles are common in these cells and were described by Virchow under the term "physaliden." The cells are usually rounded and lie in distinct spaces, but with imperfect formation of chondrin matrix they become stellate with mucinous degeneration, fusiform as they approach the connective tissue type: calcific granules may be deposited in them, and in some cases they show all transitions up to the bone cell in osteoid and osseous areas. The cells usually contain glycogen and fat granules, and well-marked fatty degeneration may occur.

Chondromas are regarded as benign tumors. Nicholas Senn, stated that true chondromas are generally regarded as benign, and displace but never invade tissue. Kaufman, however, says that a pure chondroma may metastasize, but that this occurs late, and as a result of softening and breaking of the tumor into a vein. Regional metastases to glands and growth into lymph vessels sometimes occur. Ewing states that invasion of the veins is not confined to the embryonal or teratoid chondromas, for in Virchow's case of tumor of the fibula and in Ernst's case of fibrochondroma of the spine there were extensive intravascular growths, while the pelvic chondromas in several cases have invaded blood vessels and lymphatics (Foerster, Weber, and Biesiadecki). In this group the malignant properties are often out of proportion to the cellular quality. Pure chondroma not infrequently enters veins and its ameboid cells produce distant metastases. In the notable case of Ernst's a chondroma of the vertebral column advanced through the lumbar, adrenal, spermatic, azygos, and cava inferior veins into the heart and lungs. Discontinuous metastases, usually in the lungs, have often been observed from chondromas of the pelvis, scapula, and fibula. These chondromas frequently recur after surgical removal.

ETIOLOGY

Trauma and inflammation are frequently cited as causes of ecchondroses, and trauma is not infrequently reported as preceding chondroma and chondrosarcoma (50 per cent—Weber), especially of the long bones, in which case it must be assumed that there is also a local or general predisposition. The majority of chondromas occur in early life and about puberty. Many of them are located at the growing ends of bones and in not a few there is a distinct tendency toward remaining stationary and regressing at the period when the development of the skeleton is complete. All of these facts point to an origin from disturbances in development of the cartilaginous elements in the formation of bones

and joints. An inherited predisposition has been emphasized by Weber, who observed many chondromas and ecchondroses in several members and three generations of the same family.

Virchow, von Recklinghausen, and many others have shown that rickets is an important factor in the disturbance of the growth of bones that leads to chondroma. Borst has found widely misplaced islands of cartilage in rachitic bones and believes that these may give origin to chondroma

FIG. 1. Illustration of case here reported. Antero-posterior view of spine showing extent of growth (chondroma of spine).

of limited growth, but doubts the general applicability of the rachitic theory of skeletal chondroma. Ribbert also fails to find in this theory a sufficient explanation of any large group of chondromas and thinks the disturbance must result from some unknown fetal disorder of the bones. E. Müller has described islands of superfluous cartilage in the periosteum of the ribs and has suggested that these structures may be the source of chondromas.

In von Recklinghausen's case of multiple chondromas of the feet and hands which were associated with angioma, the author assumed that congenital aplasia of the blood vessels subsequently leading to passive dilatation and angioma, prevented the normal progress of replacement of cartilage by bone and resulted in overgrowth of cellular cartilage.

Chondromas are slowly growing tumors and not painful unless a nerve be pressed upon, which does not often occur. When they involve the vertebrae they frequently produce a narrowing of the spinal canal with consequent pressure symptoms. In a few cases of chondroma of the spine which we have reviewed, age does not seem to play any part, the patients' ages varying from nineteen to sixty-five years. All parts of the spine were involved. The tumors varied in size from 1 × 3 cm. to 9 × 12 cm. One-fourth of the patients complained of pain, either very slight and indefinite or severe. The others suffered no pain at all or it came on very late and was not severe. The duration of the time when the symptoms were present varied from twenty-four hours to ten years. The symptoms usually complained of were pressure symptoms.

REPORT OF CASE

Mr. N. (service of Dr. Carl Lenhart of St. Luke'sHospital) aged thirty-six, white, married, the father of - children, whose wife had had no miscarriages. His family history was negative. He had had the usual children's diseases and typhoid fever eleven years ago. He had also had influenza and pneumonia. He denied all venereal infection. About eighteen years before, the patient had been struck on the back in the mid-dorsal region by a log.

The muscles of the limbs were in spastic condition and the reflexes of the limbs markedly increased. There were several trophic ulcers the size of a dollar on his lower extremities. He had a tumor mass the size of a lemon in the mid-dorsal region just to the right of the mid-line and apparently involving the 6th, -th, and 8th dorsal vertebrae, which was hard, fixed, and not tender on palpation nor painful. The patient had first noticed the tumor four or five months before and stated that it had grown quite rapidly. Shortly afterward he had discovered that his legs were numb. His legs grew weaker and for three months before he came under our observation he had some incontinence of urine and feces. He had been unable to walk alone for the same length of time. At no time had he suffered any pain. His limbs tended to contract and remain in that position. He had lost the sensation of heat and the sensation of touch from

the 8th dorsal vertebra down and the sensation of cold from the 12th dorsal down.

The roentgenographic examination disclosed a dense mass lying just to the right and involving the bodies of the 6th, 7th, and 8th dorsal vertebrae and the vertebral ends of the corresponding ribs. The growth appeared to be growing into the vertebral canal.

Except for a slight anemia, the laboratory findings were negative. Owing to the rapidity of the growth, it was feared that the mass was malignant and when the patient could not be promised a cure surgical treatment was refused.

A number of roentgen-ray treatments were given during the next three months, but without changing the size of the growth or improving the symptoms, although for a time the patient believed he was getting better, for the ulcers on the legs healed. Four months after his first examination, the pain having become distressing, his consent to an operation was obtained.

The operating surgeon stated that the growth was mainly on the right side and that it was pushing the cord to the left and impinging on the capacity of the vertebral canal so as to compress the cord. The operation consisted of a laminectomy over the compressed portion of the cord, laying bare about two and a half inches of the cord, and of a division of the roots along the right side. As much tumor as could be removed was curetted away.

Relief from the pain was complete. However, three days after the operation the patient became dyspneic and died before a physician could be called. The pathologists making the post mortem examination reported pulmonary embolus as the cause of death. The histological report was cartilage tissue with hyaline basement substance, or chondroma.

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HORSESHOE KIDNEY

REPORT OF CASE

BY R. M. LECOMTE, M.D.

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THE importance of horseshoe kidney in abdominal diseases has long been recognized, but it has been only within the past decade that means for diagnosis have been well enough developed and commonly enough used to give them more than vague status in pre-operative study.

Recently exhaustive studies of this renal anomaly have been made by Judd, Braasch and Scholl,[1] Rathbun,[2] and Eisendrath, Phifer and Culver.[3] These studies indicate a relative frequency in post mortem statistics of from 1 in 500 to 1 in 800 (Eisendrath), and in operative statistics of 1 in 142 (Judd, Braasch and Scholl).

At present, interest centers largely in the pre-operative diagnosis and available means for combating the condition. Eisendrath has collected a series of 133 reported cases of which 19 (14.2 per cent were diagnosed by palpation alone leaving only 9 in which modern urologic procedures were applied. The authors have analyzed these and find that the diagnoses were made on one or more of the following points: (1) Close proximity of one or both renal shadows to the spine at a lower level than normal; (2) close proximity to or obliquity of position, in relation to the spine, of the shadows of renal calculi; (3) urography, (*a*) one or both pyelograms lying in close proximity to the spine or extending across it; (*b*) one or both calyces directed mesially; (*c*) very long, narrow calyces or bizarre shapes, and (*d*) unusual course of ureter, passing behind a calyx and not entering the pelvis along its concave border.

Clinically there are no symptoms pathognomonic of the presence of a horseshoe kidney. Rovsing's sign, vague abdominal pain referred to the lumbar region, increased on leaning forward or on exertion and complete disappearance of the pain on lying down is absent in some cases of horseshoe kidney and present in some patients not having it. The clinical appearance may assume the picture of any complication that has occurred, such as stone, tuberculosis, hydronephrosis, pyonephrosis, etc. Only about one in six of the horseshoe kidneys noted at necropsy were diseased, so that many of the bearers of this anomaly probably go through life without disability from it (Rathbun).

The treatment of the condition is fairly well standardized. If a case presenting Rovsing's sign can be shown on urologic examination to present the anomaly under consideration, division of the isthmus offers a good chance of relieving the symptoms. In cases complicated by mechanical, infectious or neoplastic disease of the organ or organs, the treatment is that of the complication modified by the presence of the connecting band. Of 108 cases operated upon (Rathbun), 13 were uncomplicated, 32 had calculi, 18 hydronephrosis, 12 tuberculosis, 11 pyonephrosis, and the remaining 22 less frequent conditions. Operations performed were heminephrectomy (64 cases—8 deaths), pyelotomy (6 cases—1 death), exploration (20 cases—1 death), liberation of adhesions about ureter, decapsulation and uretero-lithotomy (1 case each—no deaths).

Where it is practicable, severing of the band and any feasible step to correct the faulty rotation of the organ should be carried out.

CASE REPORT

M. P. E., aged forty-two. Linotype operator. First seen with Dr. Herbert E. Martyn on Dec. 22, 1925.

Past History. Urethral infection, evidently gonorrhea, at the age of eighteen. He first noted pain in the left flank radiating to the left testicle at the age of twenty-three and has had similar attacks at intervals ever since. A urologic examination including cystoscopy and roentgen examination was done at the age of twenty-eight. The patient does not know the result of this examination. (A communication received from Dr. Maxwell Lick, of Erie, Penna., states that he made a diagnosis of bilateral hydronephrosis at that time and had

not advised operative treatment. The case was published in the *Pennsylvania Medical Journal*, 1919–1920, xxiii, 404.)

FIG. 1. Horseshoe kidney. The catheters diverge laterally at the level of the sacral promontory instead of following the normal ureteral course. The arrows indicate renal calculi.

Present Illness. The patient has had severe pain in the left flank, accompanied by hematuria for the past three days and has been hiccoughing constantly during that time.

Examination. The temperature was 100° F., pulse 80, leucocytes 11,000, and there was macroscopic blood in the urine. The abdomen was negative except for tenderness low down in the left ureteral region. Kidney regions were negative. He was hiccoughing constantly and was quite nervous.

Roentgen examination on December 26 showed stone shadows in the *right* ureteral region but none on the left side. On December 31, the Wassermann reaction was four plus and on January 1, neoarsphenamine, 0.6 gm. was given intravenously. The hiccoughing ceased after this and did not recur. A roentgen examination made on January 4 showed the shadow of stone in the *left* kidney area. He improved clinically after this, the fever, pain, hiccoughing, and hematuria clearing up and he left the hospital on January 7.

Examination at the office on January 9 showed urine clouded with pus but negative for albumin. He was given six doses of neoarsphenamine and on February 25 the Wassermann reaction was negative. The urine was free from pus and albumin after February 11.

Cystoscopy on March 27, 1926, showed a finely trabeculated bladder with normal ureteral orifices. The left ureter was catheterized

FIG. 2. Pyelogram of left kidney.

with a No. 5 F catheter; the urine obtained from that side was free from pus.

FIG. 3. Pyelogram of right kidney.

Since the patient was comfortable working at his trade and the kidney that had been troubling him was apparently free from infection, it was decided to treat him expectantly

until some symptom relative to the kidney developed. This occurred two weeks later, on April 15, when he began to have pain in the left back and the urine became densely clouded with pus and red blood cells.

On cystoscopy two days later there was no ureteral obstruction to No. 5 F catheters. The urine from each side was clouded from red blood and pus cells and on culture showed a gram-positive coccus. The urea content was 0.6 per cent on the right and 0.5 per cent on the left side. Roentgen examination showed the catheters diverging laterally after having reached the level of the sacral promontory instead of paralleling the vertebral column in the normal ureteral course (Fig. 1). The stone shadows were at a distance from those cast by the opaque catheters.

The pyelogram (Fig. 2) showed the catheter entering the pelvis at the upper and outer part. The pelvis was greatly enlarged and irregular in shape; there was no distinct differentiation into minor and major calyces and it did not resemble a normal kidney pelvis in any feature. From this study it was evident that we had to deal with a congenital anomaly, probably a horseshoe kidney, and a left hydronephrosis.

On April 23 a total phthalein showed a trace for the first hour and 9 per cent for the second. The bladder irritability and pyuria continued and on May 14 he was cystoscoped again and a roentgenogram taken after the injection of 60 c.c. of 12 per cent sodium iodide solution into the right kidney pelvis.

Study of the right pyelogram (Fig. 3) showed a condition similar to that on the left. Stereoscopic study of these latter films showed a small but very distinct connection between the kidneys at the lower poles. The catheters coursed laterally over the lower pole on each side and reached the pelvis at the outer and anterior part. This practically confirmed the suspicion of horseshoe kidney.

The patient developed a slight fever after this and experienced a return of the annoying hiccough which did not yield this time to injections of neoarsphenamine.

In the hope of obtaining some relief from hiccough, on May 23 at two P.M. the right kidney was explored under ethylene anesthesia. The kidney was easily located and brought into view through an oblique lumbar incision; it was freely movable and followed the respiratory excursion. In view of the patient's desperate condition it was thought best not to strip up the kidney enough to demonstrate the connecting band visually, but it could be readily palpated through the peritoneum, crossing the vertebral column. A nephrotomy was done and about 4 ounces of purulent urine discharged. A large rubber tube was inserted into the pelvis and the wound closed.

The patient reacted well from the operation and the hiccoughing ceased, but by June 3, non-protein nitrogen was 200, blood urea nitrogen 150 and creatinin 6. During this time he remained comfortable, but became weaker from day to day, the blood nitrogens increased, hiccoughing developed on June 29 and he died July 7, at 10:45 A.M.

Necropsy by Dr. Tomas Cajigas showed the presence of a horseshoe kidney (Fig. 4), the junction being at the lower poles, in the region of the fourth lumbar vertebra, by a band of kidney tissue about 1½ inches wide at the narrowest point. There was a bilateral hydronephrosis, the dilatation being more marked on the left side than on the right. On account of the distortion of the pelvis the left ureter appeared to have its exit from the anterolateral aspect of the kidney.

On section, the left kidney showed marked distention of the pelvis, which contained several small stones, the larger of which was 7 × 3 mm. in size. There was considerable atrophy of the renal parenchyma.

The renal arteries proper were distributed to the upper part of each kidney. One and one-half inches below their origin the aorta gave off two relatively small branches supplying the lower portion of the left kidney, and a larger branch, which was distributed to the lower portion of the right kidney, and to the band of renal tissue connecting both lower poles of the kidneys.

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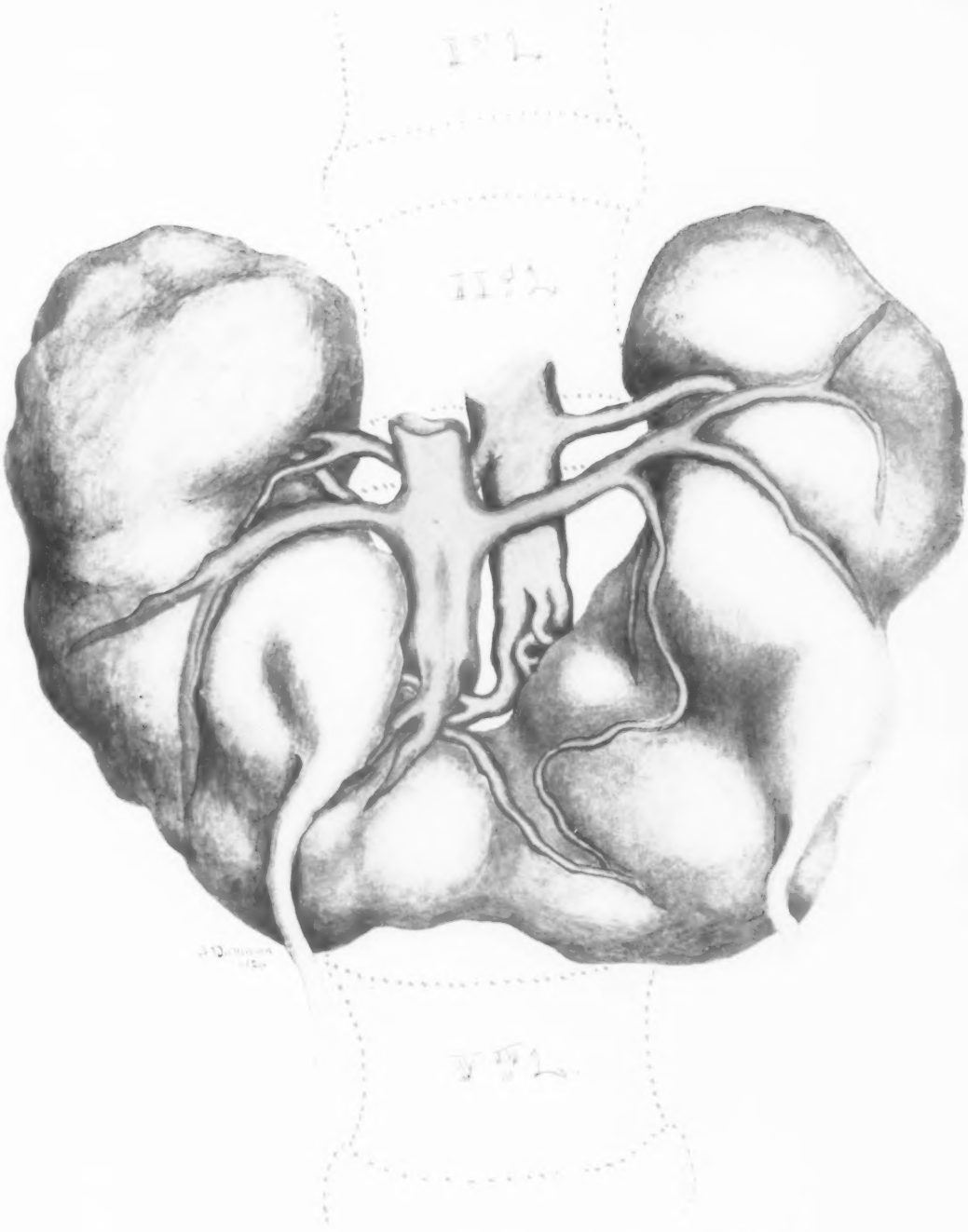

Fig. 4. Artist's drawing of autopsy specimen in case of horseshoe kidney.

THE TREATMENT OF UNCONTROLLABLE ADOLESCENT BLEEDING WITH RADIUM*

BY WILLIAM NEILL, JR., M.D.

From the Howard A. Kelly Hospital

BALTIMORE, MARYLAND

THE onset of menstruation in young girls is occasionally and without demonstrable cause excessive, amounting at times even to a protracted menorrhagia. Hemorrhage at the menarche is one of the most puzzling problems with which either the general practitioner or the gynecologist has to deal, one difficulty being that the condition lies in the genital sphere of a young woman where there is a natural objection to the first pelvic examination. The cause is evidently endocrine dysfunction incident to the inauguration of menstruation, or to some obscure factor difficult to assign to any recognized pathological entity. Fortunately, in the vast majority the tendency is towards self-correction under appropriate hygiene and medical care, and for this reason any direct gynecological intervention should be withheld as long as seems wise.

There remains, however, a small but definite group which fail to respond to medical treatment, and where a dilatation and curettement seldom prove more than temporarily effective. The hemorrhage is more or less continuous and may be of such a degree as to provoke an extreme secondary anemia. It is in behalf of these recalcitrants that I here report our results with the use of radium. Let me introduce this with a word of caution, since if improperly administered and in too great dosage, it is just as capable of stopping menstruation as is a double ovariotomy.

This report includes 30 cases; 24 had previously received from one to four dilatations with curettage, while 6 of these had had a uterine suspension without lasting benefit. The remaining 6 had been subjected to long and thorough medical treatment alone.

As a preliminary, a careful antecedent history, physical examination and blood studies are indispensable; also an examination under gas for the purpose of accurately determining the pelvic condition, together with a thorough dilatation, curettage and tissue examination. The microscopic picture generally shows a hypertrophic glandular overgrowth, or, as in a smaller number, a scanty atrophic type.

The treatment is best given internally or by the intrauterine route, but if the suprapubic route is elected there should be at least one-half gram of radium available. In our clinic at the Howard A. Kelly Hospital, the emanation, radon, is used exclusively. This, contained in a small brass capsule, 1 mm. thick, nested in a second capsule of the same material and thickness and attached to the handle of a uterine sound, is introduced into the uterus. As a rule, three capsules of equal strength are applied in tandem, approximating the canal above the internal os. The suprapubic or external method is used by exposing over each ovarian region which crossfires the pelvis. The radon is screened with 1 mm. of brass and 1 mm. of lead, placed at a distance of 5 cm. from the skin.

The modus operandi by which radium controls menorrhagia is not understood. It is undoubtedly due to a direct action on the ovarian follicle as well as upon the blood vessels of the endometrium.

Of the 30 cases included in this report, the youngest was thirteen years old and the oldest twenty-five; average age nineteen. The health in each was poor, being associated with varying degrees of secondary anemia. In 6 cases the hemoglobin was from 30 to 50 per cent.

Group 1. In 16 cases the periods became normal immediately or a few months after the treatment and have remained so.

* Read before the Baltimore City Medical Society, Baltimore, Md., Feb. 18, 1927.

4 cases for $13\frac{1}{2}$ years
1 case for $12\frac{1}{2}$ years
1 case for 9 years
1 case for 6 years
2 cases for $5\frac{1}{2}$ years
3 cases for $4\frac{1}{2}$ years
1 case for 2 years
1 case for $1\frac{1}{2}$ years
1 case for 10 months
1 case for 8 months

16

Group II. In 5 cases there was a temporary amenorrhea with later a return to normal menstruation.

1 case, cessation for 2 years; normal 10 years
1 case, occasional menstruation for 4 years; normal 9 years
1 case, cessation 6 months; normal 7 years
1 case, cessation 3 months; normal 4 years
1 case, cessation 6 months; normal $1\frac{1}{2}$ years

5

Group III. Permanent amenorrhea has been produced in 6 cases.

1 case for 3 years
1 case for 4 years
1 case for 2 years
2 cases for 1 year
1 doubtful case which has not menstruated for 6 months.

6

These patients have all experienced nervous phenomena incident to the cessation, but otherwise their health is good. From the delayed return experienced in the cases cited in Group II, we might yet expect a return of the menstrual function in 4 in Group III, leaving but 2 to be classed as definite failures. All of these were treated by the intrauterine route.

Dosage. In 15 cases in Group I, the smallest amount of radiation was 184 mc-hr., the largest 925 mc-hr.; average 583 mc-hr. In the remaining case (No. 13807), aged twenty-four, the health was almost depleted from the hemorrhage since onset of menstruation at the age of thirteen. She had been subjected to four dilatations and curettements without relief, and when seen in November, 1924, the hemoglobin was 30 per cent. Hysterectomy had been advised, and parents and patient were desirous of a permanent stoppage. For the above reasons, 1300 mc-hr. were given by the intrauterine route with immediate cessation of the hemorrhage. Irregular bleeding continued until June, 1925, when normal menstruation became established and with it a return to health and rise in hemoglobin to 81 per cent. She has recently married, with no pregnancy in less than one year.

Of the 5 cases in Group II, the smallest dose was 713 mc-hr.; largest 900 mc-hr.; average 800 mc-hr.

Of the 6 cases in Group III, the smallest dose was 500 mc-hr.; largest 900 mc-hr.; average 712 mc-hr. The average differs but little from that of Group II, and suggests a difference in individual response to the irradiation.

Marriage and Pregnancies:

Group I. One case, married two years after treatment; no pregnancies in four years; 1, married for three years prior to treatment with no pregnancies and none in six months; 1, married four years after treatment and no pregnancies in two years; 1, married one and a half years after treatment, total married life twelve years, gave birth to normal child one year after marriage, and a year and a half later there was a stillbirth at full term; three years ago was delivered of a second healthy child; both children are still alive and normally developed; 1 case, married for two years prior to treatment without pregnancies, miscarried two years afterwards at five months; 1, married four years prior to treatment with no pregnancies and none in six months; 1, married three years prior to treatment, with no pregnancies and none in two years; 1, married one year after treatment, miscarried at four and a half months, ten years later; 1, miscarried at third month, two and a half years after treatment, and died from infection associated with abortion. The remaining patients in this group are still unmarried.

Group II. One case, married at the time of treatment no pregnancies in six and a half years; 1, married after treatment, aborted thirteen months later at two and a half months.

Group III. In this group there have been no pregnancies.

Independent of irradiation, these cases are abnormal from the standpoint of conception, and it is not to be expected that pregnancy would occur with the same

frequency as in normal menstruating women. With the exception of 2, all 27 women are living and in good health. One died two and a half years later from infection, associated with an abortion as stated above, and one died two months after treatment from a cause unknown.

Three were treated by the suprapubic route alone. One (No. 10271) aged eighteen, began menstruation at thirteen, associated with irregular and profuse bleeding and had not been benefited by a dilatation, curettage, and a uterine suspension. She was first seen and treated in October, 1922, but was not benefited until the second treatment given a year later. Following this there was a gradual return to normal over a period of four to eight months, and menstruation has remained normal for more than six years; she has been married for two years with no pregnancies. The 2 remaining cases responded to one treatment, the normal function being established in six months and in two years respectively. The average total dosage used in these cases was 10,000 mg-hr.

SUMMARY

1. Only those cases not helped by the customary methods of treatment should be accepted for irradiation, and then only when the health is threatened from hemorrhage.

2. Subsequent to the treatment, the menstruation may be irregular or absent for several months, even up to four years, with later a return to normal.

3. In 6 cases of total amenorrhea, we can still hope for a return of menstruation in four.

4. There has been no serious impairment to health in any way attributable to the treatment.

5. A wide experience with radium is necessary before one is justified in using this agent in the treatment of adolescent bleeding.

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Information of interest to all readers will be found on page ii.

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Twelfth Annual Meeting: Washington, D. C., May 16 and 17, 1927.

Committee on Arrangements: Truman Abbe, Chairman, Washington, D. C.; C. Augustus Simpson, Washington; Ernest N. Dorsey, Washington.

EDITORIALS

THE COLLOIDAL LEAD TREATMENT OF CANCER

THE *Archives of Clinical Cancer Research* for December, 1926, contains a critical review by the editor, Dr. Isaac Levin, of "Lead Treatment of Cancer and the Rationale of Cancer Therapy." We consider this article a very fair summary of the present status of this method of treatment and we quote Levin's conclusions at some length below.

W. Blair Bell of Edinburgh devised this method of treatment after observing that gravid patients and animals poisoned with lead showed the greatest deposit of lead in the chorionic epithelium. Because of this special predilection of lead for cells of the embryonic type he was led to believe that it might have the same predilection for cancer cells which are also of the embryonic type.

The following table gives Bell's results of the lead treatment from Nov. 9, 1920 to Nov. 9, 1925, a period of five years:

FATE OF PATIENTS

	No. of Cases
1. Admitted, but died before treatment could be commenced	20
2. Died before treatment could be completed	50
3. Died of intercurrent affections	3
4. Died after treatment (including two deaths from acute nephritis the result of lead poisoning)	106
5. Died as a result of extensive destruction of growth by lead	4
6. Too recent for results to be estimated	14
7. Complete treatment refused but patients are living normal lives	9
8. Disease completely arrested	10
9. Believed cured, and treatment stopped	31
	247

In addition to the above table Levin gives Bell's histories of all of the cases in which he had obtained favorable results. After commenting in detail upon each of the cases Levin makes the following general criticisms.

"This origin of lead treatment resembles the treatment with Coley's mixed toxins which was based on the report that sarcoma patients became cured after an intercurrent attack of erysipelas. It resembles even more the treatment which a noted pathologist, the late Dr. Hodenpyl initiated in New York in 1909 in the following manner: A young woman suffering from primary carcinoma of the liver remained clinically well for a number of years, her only discomfort consisting in frequent accumulation of ascitic fluid. Dr. Hodenpyl conceived the idea that this ascitic fluid may contain the elements which have contributed to the spontaneous cure of the patient. He tried the injection of the fluid both on animals and patients with apparent success. Soon, however, both the original patient and the patients treated died of cancer.

"The difficulty in estimating results of cancer therapy is due to the fact that cancer takes frequently a slow chronic course with occasional spontaneous remissions lasting a long time. One must suppose that the 12 cases reported are the best of the series of Dr. Bell and of these only the first is under observation about 5 years. It is frequently advisable to present a preliminary report on the therapeutic results when the whole investigation continued only for a short time. Bell, however, presents a report of 5 years work and still he shows only one case of about 5 years' duration and one case of lymphosarcoma in which treatment was started 3½ years ago, all the other cases are under observation for 2 years or less."

. . . . . .

"The experimental and clinical investigations which Bell and his associates are pursuing are legitimate of themselves and may contribute something to the ultimate solution of the cancer problem. Unfortunately however, as is usual in cancer 'discoveries' both the public and the medical profession have become hysterical on the subject, all of which plays into the hands of the unscrupulous and spells tragedy to the cancer patient. It would have been better if Bell would have waited longer with his publication. Halstead began his work on radical surgery of carcinoma of the breast in 1894 but presented his detailed report only 10 years later.

"Bell himself gives the following estimate of his report: '*Indeed, we ourselves regard the*

results obtained in the treatment of the first 200 cases, mostly hopeless, merely as affording confirmatory support to the rest of the evidence pointing in the same direction, and not as being the outcome of a test of the merits of a new treatment,' but unfortunately neither the daily press nor the physicians who use the lead treatment of cancer in an unscientific manner repeat this statement."

. . . . .

"A specific remedy, a cure for a disease of this type is an agent which is capable of completely eradicating the malignant tumor or tumors wherever found, and thus rendering the whole organism normal; and such is indeed the mode of action of surgery as well as of radium and X-rays on cancer. They are all, therefore, specific remedies or cancer cures in the correct meaning of the term. In fact, radium and the X-rays act in a manner similar to a chemotherapeutic agent. All this is true notwithstanding the fact that at present only a small percentage of cancer patients are being cured by these methods. No specific remedy has a 100 per cent efficiency; they act best in the early stages of disease, and the same is true of these methods of cancer therapy, the results are excellent when the treatment is begun in the early stages of cancer.

"A specific remedy against cancer which is superior to surgery, radium and X-rays would have to destroy all the cancer cells throughout the organism and leave all the normal cells intact. Lead is certainly too crude a substance to be amenable to such a fine adjustment and it will take a great deal of study of endocellular function and metabolism and immense progress in biochemistry before such a fine adjustment will be made possible."

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SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this column solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

AMERICAN ROENTGEN RAY SOCIETY
Secretary, Dr. Charles L. Martin, Dallas, Texas.
Twenty-eighth annual meeting, Montreal, Can., Sept. 20–23, 1927.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. Fred M. Hodges, 801 West Grace St., Richmond, Va.
Annual meeting, Washington, D. C., May 16–20, 1927.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. Robert J. May, St. Luke's Hospital, Cleveland, Ohio.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. E. C. Samuel, New Orleans, La.
Annual meeting, Memphis, Tenn., Nov. 14–17, 1927.

BUFFALO RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. Joseph S. Gian-Franceschi, 610 Niagara St.
Meets second Monday of each month except during the summer months, the place of meeting to be selected by the host.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. R. A. Arens, Michael Reese Hospital
Meets monthly on second Thursday from October to May (except during month of December) at Virginia Hotel. Dinner at 6 P.M., scientific session at 8 P.M.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. James H. West, 8314 Euclid Ave.
Meetings are held at 6 o'clock at the University Club, on the fourth Monday evening of each month from September to April, inclusive.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. Henry L. Ulbrich, 1130 E. Grand Blvd.
Meets monthly on second Friday from October to May, at Wayne County Medical Society Building.

CENTRAL ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. H. C. Kariher, Decatur, Illinois.
Regular meetings held quarterly.

NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. M. C. Sosman, Peter Bent Brigham Hospital, Boston, Mass.
Meets monthly on third Friday, Boston Medical Library.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. W. W. Belden, 8 West 16th St.
Meets monthly on second Monday, New York Academy of Medicine.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. D. S. Childs, 316 Gurney Bldg., Syracuse, N. Y. Three meetings a year—April, August and November.

PACIFIC COAST ROENTGEN RAY SOCIETY
Secretary, Dr. Harold B. Thompson, Seattle, Wash.
Two meetings a year.

ROENTGEN RAY SOCIETY OF CENTRAL PENNSYLVANIA
Secretary, Dr. W. E. Reiley, Clearfield, Penna.
Two meetings a year, April and October.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary, Dr. Eugene Pendergrass, University of Pennsylvania, Philadelphia.
Meets monthly on first Thursday evening, Pennsylvania Hospital.

ROCHESTER ROENTGEN RAY SOCIETY, ROCHESTER, N. Y.
Secretary, Dr. S. C. Davidson, Highland Hospital.
Meets monthly on the first Friday evening at 7.45 at the Rochester Medical Association Building.

ST. LOUIS ROENTGEN CLUB
Secretary-Treasurer, Dr. L. R. Sante, Metropolitan Building.
Meets first week of each month. Time and place of meetings designated by president.

TEXAS RADIOLOGICAL SOCIETY
Secretary, Dr. Davis Spangler, Dallas, Texas.
Meets April 25, 1927, at the Orndorff Hotel, El Paso, Texas, for the one day only.

British Empire

BRITISH RÖNTGEN SOCIETY
Meets on the first Tuesday of each month from November to June inclusive, at 8.15 P.M., at the British Institute of Radiology, 32 Welbeck St., London; W. 1.

BRITISH INSTITUTE OF RADIOLOGY
Secretary, Dr. John Muir, 32 Welbeck St., London, W. 1.
Meets at 32 Welbeck St., but regular dates and times of meeting have not yet been arranged.

ELECTRO-THERAPEUTIC SECTION OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)
Meets on the third Friday of each month during the winter at 8.30 P.M. at the Royal Society of Medicine, 1 Wimpole St., London, W. 1.

RADIOLOGICAL SECTION, AUSTRALASIAN MEDICAL CONGRESS
Secretary, Dr. C. A. Anderson, The Hospital, Dunedin.

RADIOLOGICAL SECTION OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION
Secretary, Dr. Colin Macdonald, Lister House, 61 Collins St., Melbourne, Australia.
Meets monthly at Melbourne during the winter.

CANADIAN RADIOLOGICAL SOCIETY
Secretary, Dr. E. C. Brooks, Montreal.

RADIOLOGICAL SECTION, NEW ZEALAND BRITISH MEDICAL ASSOCIATION
Secretary, Dr. P. C. Fenwick, The Hospital, Christchurch.
Meets annually.

* Secretaries of societies not here listed are requested to send the necessary information to the editor.

CONTINENTAL EUROPE

BELGIAN SOCIETY OF ROENTGENOLOGY
Secretary, Dr. J. Boine, Avenue des Alliés, 134, Louvain (Belgium).
Meets monthly on second Sunday at d'Egmonds Palace, Brussels, except in the summertime.

ASSOCIATION OF GERMAN ROENTGENOLOGISTS AND RADIOLOGISTS IN CZECHOSLOVAKIA
Secretary, Dr. Walter Altschul, German University, Prag, 11/52.

DUTCH SOCIETY OF ELECTROLOGY AND ROENTGENOLOGY
Holds two meetings a year in Amsterdam, one in the Spring, and one in the Fall.

SOCIETA ITALIANA RADIOLOGIA MEDICA
Secretary, Professor M. Ponzio, University of Torino, Torino.

ALL-RUSSIAN ROENTGEN RAY ASSOCIATION, LENINGRAD, USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs S. A. Reinberg and S. G. Simonson.
Meets annually.
Fifth Annual Meeting in Kiev, Ukraine, May, 1928.

LENINGRAD ROENTGEN RAY SOCIETY
Secretaries, Drs. S. G. Simonson and G. A. Gusterin.
Meets monthly on the first Monday at 8 o'clock in the State Institute of Roentgenology and Radiology, Leningrad.

MOSCOW ROENTGEN RAY SOCIETY
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky.
Meets monthly on the first Monday at 8 o'clock, the place of meeting being selected by the Society

SCANDINAVIAN ROENTGEN SOCIETIES
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies, with the exception of the Denmark Society, meets every second month except in the summertime:

SOCIETY OF MEDICAL RADIOLOGY OF SWEDEN
Meets in Stockholm.

SOCIETY OF MEDICAL RADIOLOGY IN NORWAY
Meets in Oslo.

SOCIETY OF MEDICAL RADIOLOGY IN DENMARK
Secretary, Dr. H. Scheuermann, Copenhagen
Meets on the second Wednesday of each month from October to July in Copenhagen, at 8 o'clock in the State Institute of Roentgenology.

SOCIETY OF MEDICAL RADIOLOGY IN FINLAND
Meets in Helsingfors.

VIENNA SOCIETY OF ROENTGENOLOGY
Secretary, Professor Holzknecht, Vienna, IX, General Hospital.
Meets on the first Tuesday of each month from October to July.

MONTREAL, CONVENTION CITY FOR 1927

The American Roentgen Ray Society, in selecting Montreal as the scene of its convention for 1927 has chosen a city rich in historic memories, in beauty of situation, and in natural and man-made features of great interest to every visitor. Not the least of Montreal's attractions for the members of the healing art are its high standing in medical and scientific education, and its splendidly equipped hospitals. The city is the seat of two universities whose fame extends far beyond the borders of Canada—McGill and the Universite de Montreal, the latter the center of French-Canadian higher education, as McGill is, with its friendly rival the University of Toronto, the leader of English-speaking culture in the Dominion. Sir William Osler, that famous well-loved physician, was a graduate of McGill and returned to join its faculty, passing thence to the University of Pennsylvania, then to Johns Hopkins University and later to Oxford. Sir Ernest Rutherford, whose researches into the structure of matter have led to epochal discoveries; Sir Auckland Geddes, honored for his war work by the appointment as British Minister to Washington, and Dr. Adami, who died within the past year as Vice-Chancellor of Liverpool University, were all professors at McGill before the war, and the late Col. John McCrae, who wrote that finest of war poems, "In Flanders Fields" was, like Osler, both a graduate and a faculty member of McGill. The Universite de Montreal has also had its graduates and professors who have won corresponding fame in French-speaking Canada and in France.

While Montreal, in common with many other large cities, suffers somewhat from a shortage of hospital accommodation for its million inhabitants and the half-million more in its tributary territory, those institutions which it possesses are models of their kind. The three major hospitals—Royal Victoria, Montreal General and the Notre Dame—in their personnel and their equipment rank with the best on the continent of North America, and their facilities are supplemented by those of a dozen smaller but well-conducted institutions. All these are available for the clinics, demonstrations, lectures, etc., which are naturally a part of the program of medical and surgical conventions, and the delegates to the gatherings of the

Royal Victoria Hospital.
The tree-clad mountainside makes a picturesque background for the Royal Victoria Hospital, Pine Ave. West.

Mount Royal Hotel.

American Roentgen Ray Society will find their confrères in Montreal eager to extend a cordial hospitality, both in the professional and the social features of the occasion. The meetings will take place September 20 to 23 inclusive, with the headquarters at the Mount Royal Hotel, Montreal's newest and largest hostelry. Local committees, under the leadership of the Society's president-elect, Dr. A. H. Pirie, of Royal Victoria Hospital, Montreal, are already at work planning to make this convention the most successful and most enjoyable in the history of the Society.

AMERICAN RADIUM SOCIETY

The Twelfth Annual Meeting of the American Radium Society will be held in Washington, D. C., at the Mayflower Hotel, on Monday and Tuesday, May 16 and 17, 1927. All members of the American Roentgen Ray Society are cordially invited to attend both the scientific sessions and the banquet. The secretary, Dr. Edwin C. Ernst, 412 Humboldt Bldg., St. Louis, Mo., will be pleased to furnish additional information in reference to the meeting to anyone interested.

PRELIMINARY PROGRAM

May 16, 1927—Morning Session

1. Dr. J. A. Corscaden. "Arthritis and the Radiotherapeutic Menopause."
2. Dr. Leda J. Stacy. "Complications Following the Use of Radium in Gynecology." Discussion: Dr. O. E. Norsworthy, Dr. W. S. Stone, Dr. F. J. Taussig.
3. Dr. Wm. L. Brown. "Radium in the Treatment of Leukemia." Discussion: Dr. H. H. Bowing, Dr. Robert E. Fricke, Dr. George R. Minot.
4. Dr. M. J. Sittenfield. "Critique of the Biological Effects of Radium in Cancer." Discussion: Dr. H. J. Ullmann, Dr. Edwin C. Ernst, Dr. Robert B. Greenough.

Afternoon Session

5. Dr. Ira I. Kaplan. "Mouth and Face Conditions Treated by Radium Emanation at Bellevue Hospital, New York City." Discussion: Dr. Robert P. Wadhams, Dr. J. M. Johnson.
6. Dr. Isaac Levin. "Radium Versus Roentgen Therapy in Carcinoma of the Cervix."
7. Dr. L. A. Pomeroy. "Five-year Results of Radium Treatment in Carcinoma of the Cervix Uteri." Discussion: Dr. Wm. P. Healy, Dr. Clark D. Brooks, Dr. Grant E. Ward.
8. Dr. G. Failla. "Designs of a Well Protected Radium Pack." Discussion: Dr. Otto Glasser.
9. Dr. G. Allen Robinson. "Radium Treatment in Tuberculous Adenitis," Discussion: Dr. H. H. Bowing, Dr. George E. Pfahler.

6:30 p.m., Annual Banquet. The arrangements for this program are to be supplemented later by the Local Committee, in addition to our guest and speaker of the evening: Dr. Franklin L. Hunt, Bureau of Standards, Washington, D. C. Title: "Radiation Standardization Problems."

May 17, 1927—Morning Session

10. Dr. Sanford Withers and Dr. John R. Ranson "The Treatment of Extensive Hemangiomas in Infants."
11. Dr. A. Strauss. "Radium Treatment of Cavernous Hemangioma and of Epulis."
12. Dr. Wm. H. Schmidt. "Treatment of Cavernous Naevus Covered with Healthy Skin by Radium Needles." Discussion: Dr. Arthur C. Heublein, Dr. William Neill, Jr., Dr. E. C. Samuel.
13. Dr. Wm. L. Clark. "Combined Methods in the Treatment of Rectal Carcinoma." Discussion: Dr. Harvey B. Stone, Dr. Curtis F. Burnam.

Afternoon Session

14. Dr. H. K. Pancoast. "Radiation Treatment of Brain Tumors." Discussion: Dr. Douglas Quick, Dr. C. F. Burnam.
15. Dr. M. C. Sosman. "Response of Various Type of Gliomas to X-ray Therapy."
16. Dr. H. H. Bowing. "Malignant

Tumors of the Thyroid Treated by Surgery, Radium and Roentgen Rays."

17. Dr. R. E. Loucks. "Clinical Evidences of Thyrotoxic Control after Radium Therapy." Discussion: Dr. T. D. Quigley, Dr. James T. Case, Dr. Douglas Quick.

NEW YORK ROENTGEN SOCIETY

The 105th meeting of the New York Roentgen Society was held at the New York Academy of Medicine on February 11 and 12, 1927, with Dr. John Remer, the president, presiding. The Philadelphia Roentgen Ray Society and the New England Roentgen Ray Society were invited as guests.

The Friday evening program was devoted to a symposium on "Bone Diseases." Dr. James Morley Hitzrot of New York read a most interesting paper on the "Clinician's Problems on Bone Diseases," which he illustrated with many excellent lantern slides.

Dr. Leopold Jaches of New York read a paper on the "Roentgenological Aspect of Bone Diseases" in which he discussed the possibility of the early differential diagnosis of Paget's disease from osteoplastic metastasis. This paper was also illustrated by lantern slides.

Dr. J. W. Denton of Cornell University then discussed these changes from the pathological standpoint.

Dr. H. K. Pancoast of Philadelphia opened the discussion, and it was continued by Dr. Ralph Herendeen of New York who showed a case of osteomyelitis which had been treated by roentgen rays with a resulting cure after the bone had broken down. This case was previously diagnosed as osteogenic sarcoma.

There was then considerable general discussion; Dr. Belden showed a case of Paget's disease with a coexisting sarcoma in the head of the humerus.

On Saturday morning, Dr. Lewis Gergory Cole of New York discussed "Gas Tube Technique" and the differences between gas tubes and the Coolidge tube. This brought out much discussion.

Dr. George Holmes of Boston then showed an exceedingly interesting case of neuroblastoma involving all the bones of the body. This also brought out considerable discussion, especially as to ability to differentiate this condition from Gaucher's disease. Dr. Holmes then discussed whether or not it was possible to demonstrate sacroiliac disease or subluxation after fracture and also discussed the variations in the pubes. Dr. Imboden stated that no conclusions could be drawn from this variation.

Dr. Holmes then reported two cases of recurrence of the thymus in children after roentgen therapy. The consensus of opinion in the discussion of this was that the children had not received sufficient irradiation. Dr. Holmes then discussed antispasmodics at length. He described their experiments with amyl nitrite and nitroglycerine. They found that these drugs were slightly more advantageous than atropine but that none of these drugs were entirely reliable in the relaxation of spasm of the stomach.

Dr. W. H. Stewart of New York discussed the Graham test at some length. This brought out discussion by Drs. Cole, Belden, Sosman and a number of others.

Dr. D. R. Bowen, Philadelphia, then showed four lantern slides illustrating a technique for the stereoscopic examination of the mandible and of the mastoid.

Dr. G. E. Pfahler, Philadelphia, opened a discussion on "Roentgen Therapy." In the discussion which followed it seemed to be the consensus of opinion that high voltage therapy was unquestionably a step in advance in the treatment of deep-seated malignant disease.

Dr. W. F. Manges, Philadelphia, reported a case of congenital fistula between the trachea and esophagus proven by autopsy.

Dr. H. K. Pancoast, Philadelphia, showed two very interesting cases of localized pneumothorax, one with interlobar empyema, both in young children.

Dr. Fred Law, New York, showed several cases in which lipiodol had been injected into the nasal accessory sinuses and into the mastoids. In the case of the mastoid, the lipiodol was retained about

a year after the injection, but in the case of the nasal accessory sinuses the lipiodol drained very promptly.

Between the morning and afternoon sessions the New York Roentgen Society served a buffet luncheon at the Academy.

At the end of the afternoon session Dr. Jaches moved that a similar meeting be held next year. This motion was carried. The meeting then adjourned.

Webster W. Belden,
Secretary.

BOOK REVIEWS

Books Received Are Acknowledged under Heading: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

ERGEBNISSE DER MEDIZINISCHEN STRAHLENFORSCHUNG (RÖNTGENDIAGNOSTIK, RÖNTGEN,- RADIUM- UND LICHTTHERAPIE). (Advances in Medical Radiology [Roentgen Diagnosis, Roentgen, Radium and Light Therapy.] Volume II. By H. Holfelder, Frankfurt a. M., H. Holthusen, Hamburg, O. Jüngling, Tübingen, and H. Martius, Bonn a. Rh. Paper, price, 52.50 Marks; Bound, price, 57 Marks. Pp. 594, with 520 illustrations and 3 photographic plates. Leipzig: Georg Thieme, 1926.

The favorable comment with which the first volume of this work was received is equally merited by the second volume which is here under review. Included in Volume II are nine monographs by some of the outstanding authorities of Germany and Austria. The physical appearance of the work is naturally the first thing to draw the attention; and we are impressed with the beautifully clear format and illustrations—a tribute at once to the editors and printers. Many of the text illustrations in this volume are colored and there are included a number of photographic reproductions of roentgenographic films. There is an attractiveness about the whole work that we find, alas, too infrequently among scientific works of the present day.

The first monograph, 106 pages long, is entitled "*Ventriculography or Encephalography as an Aid in the Diagnosis of Diseases of the Brain (with Special Reference to Brain Tumors)*" by Otto Jüngling of the Tübingen Clinic. This fertile field for diagnosis was opened up by the work of Dandy in 1918 who termed the procedure ventriculography. Bingel in Germany in 1920, apparently without knowledge of Dandy's work proposed a similar procedure and termed it encephalography. At about the same time Wideröe in Oslo, Norway, proposed the same idea. By the application of ventriculography or encephalography the symptomatology of many brain conditions has been extended considerably. In the case of hydrocephalus it has permitted not only early diagnosis, but also the differentiation between the communicating and obstructive types. New ventriculograms are revealing a variety of deformations and changes in the brain ventricles, especially the lateral ventricles, due to contractive processes and tumors. As regards the latter, an entirely new symptomatology is in the process of development and although numerous pictures are already known, each new case may bring a surprise. However, there is observed a recurrence of typical pictures so that there appears to be gradually developing, at least in broad outline, a foundation for the diagnosis of brain tumors and other brain diseases on the basis of the ventricular picture. There are naturally limits to the purely neurological methods of diagnosis just as there are undoubtedly to the ventriculographic, and a proper appreciation of the limitations of both fields is necessary.

Dr. Jüngling's monograph is divided into three parts. The first deals with the general anatomical features underlying the ventriculographic picture and technique. The second section deals with the variations from the normal picture and their interpretation. In this section are discussed the problem of hydrocephalus, and deformations of the ventricles caused by tumors. The third section deals with the clinical importance of ventriculography; the question of hazard to the patient, local and general irritation and the indications and contraindications to the procedure. A number of typical cases are described and discussed. Emphasis is placed on the fact that ventriculography is useful in diagnosis because it is able to detect by very characteristic signs those tumors which most frequently escape clinical diagnosis by neurologic methods. An extensive bibliography is appended.

"*Myelography as an Aid in the Diagnosis of Diseases of the Spinal Cord*" by Herbert Peiper, Frankfurt, is the second monograph, 90 pages long. The various surgical procedures necessary in dealing with different conditions of the spinal cord are fairly well established and are quite satisfactory under the circumstances. Necessarily, surgical procedures must depend on prior diagnosis, and here we encounter the weakest point in the whole problem of treating diseases of the cord. The neurological method of diagnosis is in general unsatisfactory, although it must be conceded that a few neurologists of wide experience are capable of rendering consistently correct diagnoses. The examination of the spinal fluid yields only collateral evidence, usually indirect. Roentgenological localization of compression of the cord with the aid of injected contrast material constitutes

a revolutionary improvement. Although myelography is still very young and is regarded rather skeptically in some quarters, the opinion of experienced neurologists and neurosurgeons is that it will become generally adopted. One of the prime virtues of the method is that it renders unnecessary in many cases the application of so-called trial laminectomy which in the past has so often been demonstrated to be useless. It is emphasized that myelography with the introduction of iodized oil in the spinal canal is a specialized surgical procedure; and a useful myelographic study and interpretation cannot be made unless the myelographer possesses adequate neurological training. The interpretation of the myelogram demands a knowledge of the anatomy and structure of the spinal cord and its adjacent structures, especially the arachnoid spaces; it also demands a knowledge of the gross pathological anatomy and of the position and development of tumors of the spinal cord, together with the resulting changes in the cord and its integuments. This new diagnostic procedure is not an independent one and should be considered in conjunction with the older proven methods which are by no means supplanted.

This monograph by Dr. Peiper is based on a special study of operative cases in which the myelographic diagnoses were confirmed at operation. In addition, the international literature on the subject has been consulted in the preparation of this work. Following a brief discussion of the results obtained in the roentgen examination of the spinal column for tumors, there is a brief discussion of myelography with injections of air. Quoting Dandy's recent dictum: "Since the advance of Sicard's method, any hesitancy in diagnosis or localization could better be cleared by this oil" (referring to iodized oil), Peiper proceeds to the discussion of myelography with iodized oil. This discussion includes all the essentials from indications and contraindications to interpretation of myelograms. An exhaustive bibliography is appended. It may be of interest to note that the foregoing two monographs have been combined and published as a separate volume under the title of "Ventriculography and Myelography in the Diagnosis of the Central Nervous System" under the joint authorship of Jüngling and Peiper.

"*The Roentgenogram of Interlobar Pleuritis and Its Differential Diagnosis*" by Felix Fleischner, Vienna, is the third monograph. This review discusses in 52 pages: the anatomy of the lobar interspaces; the physiology and physics of pleural effusions as related to roentgen diagnosis; the technique of examination; interlobar induration; interlobar effusion. The purpose of the work is to describe the characteristic pictures of interlobar effusion so as to facilitate definite diagnosis.

"*The Direct Roentgen Symptoms of Duodenal Ulcer and Their Clinical Significance*" by Hans H. Berg, Frankfurt, is the next monograph. Within the compass of 94 pages Dr. Berg discusses the technique of examination, the anatomical and physiological relations of the upper portion of the duodenum in the roentgenogram; pathological-anatomical features in relation to the roentgen finding; the direct roentgen symptoms, (a) niche and changes in the outline of the mucosa, (b) cicatricial changes in the ulcer and their relations to the neighboring organs in the roentgenogram, (c) functional responses in the bulbus duodeni; the direct roentgen symptoms of duodenal ulcer as related to the periodicity of the disease and its relation to the whole roentgen finding; the positive and the negative finding; differential diagnosis of deformities in the bulbus; clinicial importance of the detailed study of the bulbus. There is appended an extensive bibliography. Illustrative cases are cited and many pictures are presented including a number of photographic reproductions of the pyloroduodenal roentgenogram. A roentgenological analysis of the duodenum as followed by the Forssell school is the basis of the author's discussion. The employment of small amounts of contrast material permits demonstration of the elevations of the duodenal mucosa, thus disclosing swellings and contractions. This permits also the recognition of the radial converging furrows in cases of advanced cicatrization and also furnishes roentgenological evidence of the multiplicity of peptic defects. This improved technique of determining the pathological-anatomical details has an additional value in indicating the proper therapeutic procedure in individual cases. The direct roentgen diagnosis of duodenal ulcer can nowadays be made as fully reliable as that of gastric ulcer and exceeds the latter as regards the precision and frequency of positive findings.

"*The Effect of Short Waved Radiations on the Acid-base Equilibrium in the Body, Especially on the Blood Reaction*" by Christian Kroetz, Greifswald, is a review in 36 pages of the results of recent research to which Dr. Kroetz has been a fruitful contributor. Two groups of phenomena are apparent, one a considerable increase in so-called unknown acid residual valences, the "anion deficit" of the serum, and the other the simultaneous alterations in blood proteins. The interpretation of these has been the subject of recent controversy.

"*The Radiation Treatment of Bronchial Asthma*" by Felix Klewitz of Königsberg, is

a brief clinical discussion. Within the span of 10 pages are considered the types of cases amenable to irradiation, the technique and dosage, and a summary of the results obtained by the author in a total of 121 cases, of which 18 are briefly cited. There is also added a discussion of the mode of action of the rays.

"*The Effects of Experimental Irradiation of the Ovaries*" by Friedrich C. Geller of Breslau is a monograph of 30 pages in which attention is directed mainly to the results of experimental research in animals. In addition there is presented a brief discussion of the medical problems involved in the irradiation of the ovaries in women. This critical review should be of value to the student as well as to the clinician.

"*Endovesical Electrocoagulation*" by Karl Scheele, Frankfurt, presents within the span of about 75 pages a discussion of the indications, technique and results of this method of treatment of cystic disease. The first portion of the monograph deals with the general use of electrical current for endovesical operations, the apparatus and instruments and their effects, and the general technique of electrocoagulation. The second half of the work deals with the various forms of cystic tumors and their treatment; vascular diseases of the bladder, cystic dilatation of the vesical portion of the ureter; intramural ureteral stones; inflammatory diseases of the bladder; and electrocoagulation in the region of the neck of the bladder. The application of electrocoagulation and fulguration in endovesical therapy has in a very short time established itself on a substantial basis and has yielded important results. The new method naturally has betrayed certain inherent disadvantages which must be recognized. On the other hand, it has become clear that the treatment of cystic papillomas by this method when properly carried out has come to be recognized as the treatment of choice.

"*The Roentgen and Radium Treatment of Carcinoma of the Tongue*" by Erich Schemp, Tübingen, presents a critical summary of the subject in 50 pages. The roentgen and radium treatments are described in detail as regards technique, dosage and indications. The intratumoral administration of radium is also discussed and the results obtained with each mode of treatment are reviewed. A number of illustrative cases are cited.

Extensive author and subject indices for the whole volume are appended.

Containing as it does up to date monographs and critical reviews of special fields of roentgenology, this volume should constitute a valuable reference work to all interested in the science.

B. Cohen.

INTERNATIONAL ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

Belfield, W. T., and Rolnick, H. C. Roentgenography and therapy with iodized oils. *J. Am. M. Ass.*, June 12, 1926, lxxxvi, 1831–1833.

The authors have studied the therapeutic effects of various iodized oils after injection into the seminal ducts through vasotomy, usually bilateral, in 67 men, with immediate roentgenograms in all. The viscosity of lipiodol and iodipin renders the filling of the vesicles difficult and at times incomplete. The failure of absorption of lipiodol is shown by its persistence in the vesicles and in the connective tissue at the internal inguinal ring (Bogros' space), into which it was intentionally injected by way of the sheath of the scrotal vas.

Since animal oils are more readily absorbed, the authors have tried to dissolve iodine and its compounds in each of several animal oils The prime object was therapeutic efficacy with harmlessness. Two solutions have been found satisfactory. The first consists of iodol, 10 gm., in cod liver oil 40 c.c. giving a mixture containing more than 18 per cent of iodine. The second solution consists of 10 gm. thymol iodide in 30 c.c. of cod liver oil, giving a solution containing 12 per cent iodine. Either liquid clears the vesicles of gonococci and of pyogenic bacteria commonly found there. They are sufficiently fluid to fill the vesicles without undue pressure; and they are absorbable and do not stimulate cicatrix formation.

The iodol-oil mixture gives roentgenographic shadow of the vesicles, less dense than that furnished by the customary collargol 10 per cent solution, or by lipiodol. It is possible that these iodized oils may be found useful in other fields of roentgenography as harmless and inexpensive substitutes for lipiodol and iodipin.

Attention is called to the clinical importance of Bogros' space especially to industrial surgeons. The sheath of the intrapelvic vas is usually not continuous with the sheath of the scrotal vas. Each segment ends in the intervening loose connective tissue at the internal inguinal ring; hence infections traversing the sheath of the vas from the vesicles diffuse into this space causing tender swellings, even suppuration, at the internal ring which simulate hernia. A good many "industrial hernias" are nothing else than infections that have traversed the vas to Bogros' space from the vesicles. An illustration is presented showing the persistence of lipiodol in Bogros' space and vesicles thirty-seven days after injection. The oil which was injected toward the body within the sheath of the scrotal vas, had diffused through Bogros' space but did not enter the sheath of the pelvic vas.

Bennett, T. Izod, Moncrieff, Alan, and Nicholas, F. G. Observations on cholecystography. *Lancet*, July 3, 1926, ii, 19–21.

The authors have employed tetraiodophenolphthalein (iodeikon) by oral administration with good results. The dye was given in formalinized gelatin capsules which must be freshly prepared, because if kept for more than twenty four hours they become too tough for proper digestion. A brief analysis of 58 cases is given.

The importance of taking a roentgenogram before administration of the dye has not hitherto been sufficiently emphasized. The gall-bladder may give a definite shadow in this preliminary plate. If after administration of the dye there is no increase in the density of this shadow, it is evidence that no dye has entered the gall bladder. Certain other shadows such as those of renal calculi, etc., may also be present and are less likely to lead to erroneous deductions if seen clearly in the preliminary plate. When definite gallstone shadows are seen before the administration of the dye, there is no need to continue with cholecystography. But if certain vague shadows in the preliminary plate are seen to coincide with a patchy gall bladder shadow after administration of the dye, it is strong confirmatory evidence of their nature.

It is most important to observe the alimentary canal and especially the cecum for the presence of unabsorbed dye. The importance of securing proper absorption of the dye cannot be overestimated. In examining the shadows of the gall bladder attention should be given to the variations in size and density on the series of films. A healthy gall bladder may cast a surprisingly large shadow, but there should in the second film be a distinct diminution in this size with an increase of density due to concentration of contents and contraction of the walls of the gall bladder, which are the normal functions of the non-infected organ.

Buckstein, Jacob. Deformity of the air bubble of the stomach in carcinoma. *J. Am. M. Ass.*, June 12, 1926, lxxxvi, 1834.

The normal air bubble has wide variations

as to size and shape, but all agree as to the absence of any irregularity in contour. By a careful inspection, irregularities due to the projection within it of an infiltrative mass may be noted, and a diagnosis of carcinoma of this region made, even prior to the administration of a barium meal.

To emphasize the significance of the deformed bubble, the author presents roentgenograms from 3 cases of operatively demonstrated carcinoma of the cardiac zone of the stomach. One shows the deformity due to the projection of a mass into the bubble, making the base convex. The second shows the deformity due to the projection of an irregular mass, the base of the bubble being irregular. The third shows extreme deformity with almost total disappearance of the bubble because of the irregular infiltrative mass.

CASE, JAMES T., and COOPER, JOHN E. The early diagnosis of anencephalus. *Surg., Gynec. & Obst.*, August, 1926, xliii, 198–203.

Four cases are reported in which the diagnosis of anencephaly was made before the beginning of labor. In each case the diagnosis was based upon atypical physical findings plus the proof furnished by the roentgenogram, and verified by operation. A brief review of the literature shows that without the roentgen examination it is possible to do no more than conjecture the presence of anencephaly. It is therefore reasonable to urge a routine roentgen study of all obstetrical cases presenting hydramnios, when there is difficulty in identification of the fetal poles, or when the fetal heart sounds are weak or uncertain. With the aid of the roentgen ray it is possible to state definitely whether or not there exists an anencephalus.

A brief review is given of the cases of anencephaly thus far reported in the literature and successfully recognized before the onset of labor. Anencephaly represents only a relatively small proportion of fetal monstrosities, and the monstrosities represent only a small part of the field of usefulness of the roentgen ray in obstetrical practice.

The technique of the roentgen examination is as follows: Films may be exposed with the patient lying on the side or prone upon the film. In the latter case pillows are placed under the hips and chest in order to prevent undue pressure upon the distended abdomen. By the employment of fine focus tubes, double intensifying screens with films, and the Potter-Bucky diaphragm, excellent roentgenograms are easily obtainable even with a bedside outfit. The abnormal development of the base of the skull with small orbital cavities, absence of sella turcica, absence of cranial bones, and more or less extensive spina bifida afford opportunity for prenatal recognition of anencephalus in the roentgenogram. Normally the rounded outline of the cranial vault is the most conspicuous part of the unborn fetus in the roentgenogram; in anencephaly the bones of the face and base of of the skull cast a shadow rather more dense than usual, the rounded outline of the cranial bones being conspicuously missing.

CASE, JAMES T., and UPSON, W. O. Roentgenologic aspects of various types of hernia. *J. Am. M. Ass.*, Sept. 18, 1926, lxxxvii, 891–898.

Cases of hernia have been encountered in the roentgen examinations which have been very interesting, and at times life saving. Some of these experiences have occurred with ordinary inguinal and postoperative ventral hernia and others with umbilical hernia; but the most striking have been found with diaphragmatic and intra-abdominal herniations. The authors have had no case of femoral hernia in which the roentgenograms have been helpful.

A review of the results of operation or necropsy in several hundred cases of hernia involving the abdominal contents reveals interesting possibilities in the way of roentgenographic diagnosis. The possibility of encountering hernia should be kept in mind during routine barium meal studies. Special technique is required by special types of hernia, such as diaphragmatic, retroperitoneal and postoperative hernia in which the roentgen study offers the greatest likelihood of affording useful information.

Paraduodenal Hernia. It is possible to diagnose correctly retroperitoneal hernia involving the bowel. The roentgenograms in two of the authors' cases are presented. The disposition of the small bowel was typical showing the spherical well bounded zone in which the small intestine was confined. The confined intestinal coils could not be disturbed by any amount of manipulation or change of position of the patient. The part of the small bowel thus compressed into an ovoid mass remains supported high in the abdomen when the patient assumes the erect position, whereas the normal bowel gravitates toward the true pelvis with the patient erect. There is often a marked distortion or displacement of the colon and sometimes also of the stomach. In some cases the entire colon lies in the left side of the abdomen so that the small bowel appears in the right upper quadrant suggesting a congenital failure of the colon to rotate. One of the obstacles to correct interpretation lies in the differentiation between retroperitoneal hernia and incomplete rotation of the colon. In every

case which seems to present evidence of incomplete rotation, that is, in which the duodenum comes from the pylorus directly toward the right, with distribution of the upper jejunum on the right instead of on the left of the midline, one should suspect a possible paraduodenal hernia.

Paracecal and Intersigmoid Hernia. A hernia into the paracecal fossa is a great rarity and in the case observed by the authors the cecum occupied the normal position. Stereograms showed that several coils of the small intestine occupied a position behind and to the right of the ascending colon and cecum. These herniated coils were so densely adherent that it was necessary to resect 20 inches of terminal ileum, cecum and ascending colon with end to-side anastomosis to give relief. The patient remains in excellent health fourteen years after the operation. The authors have not recognized a case of hernia into the intersigmoid fossa. To recognize the presence of small intestine behind or between the layers of the sigmoid mesocolon, stereoscopic and roentgenoscopic manipulative studies should be made with a combined barium meal and opaque enema so that the small intestine and the sigmoid may be filled simultaneously.

Hernia into the Lesser Peritoneal Cavity. This presents a more fertile field for roentgen investigation. The proper reading of the roentgenograms in several cases was possible after repeated examination and the use of manipulation with the protected hand under the roentgenoscopic screen. The stereoscopic films must be made with very brief exposure and with very little interim between two exposures. Good results are obtainable only with apparatus that permits a completion of the two films within one and a half or two seconds, the breath being held in the meanwhile. Hernia through the foramen of Winslow occurs as frequently as right duodenal hernia. To establish the existence of such a hernia, the small bowel should be identified anterior to the hepatic flexure or the first part of the transverse colon. The small bowel may also pass into the lesser peritoneal sac through a breach in the transverse mesocolon; and the hernia, as is curiously the case in the majority of instances reported, may be associated with a coexisting gastric or duodenal ulcer, though no satisfactory explanation has been offered for the coexistence of the two lesions.

Diapbragmatic Hernia. These usually occur through the posterior part of the diaphragm on the left side. Right sided hernias occur only about once to ten times on the left side. The practical difficulty in differential diagnosis is the similarity of the roentgenogram in relaxation or eventration of the diaphragm and in true diaphragmatic hernia, especially in the traumatic cases. The contents of the hernia may include stomach, small intestine, colon, omentum, liver, spleen, pancreas and kidney. Even with the aid of the screen or roentgenogram the lesion is sometimes found only after several examinations. Spontaneous reduction of the hernia may occur just prior to the roentgen-ray study, thus contributing to diagnostic failure. The diagnosis of diaphragmatic hernia depends on proof of the absence of the intact normal, rounded dome of the diaphragm with characteristic thoracic shadows above the rounded dome. The hernia having been discovered it should be possible, especially with the patient in the erect position, to detect the air globus in the highest part of the gastric fundus within the thorax and to see through it the superimposed shadow of pulmonary markings characteristic of the base of the lung. In a differential diagnosis one must consider and rule out the following: eventration; diverticulum of the esophagus; hour glass stomach; sacculated air or fluid air in the chest; thoracic stomach; diverticulum of the stomach, and gastric ulcer causing cicatricial contraction with concomitant relaxation of the left diaphragm.

Umbilical, Inguinal and Femoral Hernia. In the majority of umbilical and inguinal hernias the roentgenograms are not of great interest although they may yield some interesting discoveries of secondary importance and symptoms of great rarity. This is illustrated for instance when there is shown in the hernia a portion of the stomach or the appendix, especially when the latter is shown to be situated in a left inguinal hernia, or when one plans to remove the appendix in connection with an operation for right inguinal hernia. One of the surprising conditions observed by the authors was an extensive herniation of the sigmoid in an inguinal sac with multiple diverticula in the herniated sigmoid.

Postoperative Hernia. The roentgenographic examination with the opaque meal or possibly with pneumoperitoneum is a fairly constant indication in postoperative hernia which is suspected of causing trouble, especially where there is a history of recurring attacks of abdominal distress. There may be no actual emergence of abdominal contents, the hernia consisting of only a slight separation of the muscle at the site of the wound. When intermittent obstruction is suspected roentgen studies should be made hourly, beginning immediately after the barium meal, as long as opaque material remains in the small intestine.

CHRISTIE, A. C. Osteochondritis, or epiphysitis. *J. Am. M. Ass.*, July 31, 1926, lxxxvii, 291–295.

Brief descriptions are given of the following: (1) osteochondritis deformans juvenilis coxae; (2) Osgood-Schlatter's disease; (3) Köhler's disease of the tarsal scaphoid; (4) Köhler's disease of the second metatarsus; (5) vertebral epiphysitis; (6) miscellaneous conditions classifiable as epiphysitis: (a) epiphysitis of the os calcis; (b) osteochondritis dissecans of König.

A typical case of vertebral epiphysitis in a girl aged fifteen is briefly described. The roentgen examination showed the presence of slight scoliosis and marked kyphosis in the lower dorsal and upper lumbar region. The bodies of the three lower dorsal and two upper lumbar vertebrae were somewhat beveled and irregular on their superior and inferior aspects. The epiphyses where they could be seen were fragmented and indistinct and the joint spaces were hazy.

FRIGYÉR, LADISLAUS. Roentgen examination of the gall-bladder in normal individuals with the aid of tetraiodophenolphthalein. *Klin. Wchnschr.*, July, 23, 1926, v, 1369–1371.

The shape of the normal gall-bladder as it appears upon the plate is exceedingly variable although always sharply outlined. It is usually the shape of an elongated pear, heart, or acorn. The length of the normal gall-bladder shadow corresponds to the height of one to one and a half lumbar vertebrae. The normal gall-bladder is movable and lies at a lower level in the upright posture than in the recumbent. In cases with a normal chest cavity the gall-bladder is found between the first and second lumbar vertebrae, and in asthenic individuals its shadow often reaches the third lumbar vertebra. In asthenic individuals even without abnormalities of the thorax there may occasionally be seen a sinking of the gall-bladder down to the fourth lumbar vertebra, associated with ptosis of the other organs.

Spontaneous pain and pressure sensitiveness are not confined entirely to the space beneath the arch of the ribs in gall-bladder disease. In the case of low gall-bladder the pressure sensitiveness may be occasionally observed at an atypical point, even in the region of the appendix in certain circumstances. Pressure sensitiveness in such cases can be properly interpreted only after a cholecystographic examination.

To visualize the gall-bladder the author injects 0.04 gm. of the dye per kilogram of body weight, the material being dissolved in 50 c.c. of water and injected very slowly in two injections. One-half hour preceding the injection of the dye an intramuscular injection of 2 c.c. of hypophysin and 1 mg. atropin is given. In the series of 30 cases upon which this report is based no troublesome after effects occurred.

GRAHAM, EVARTS A., COLE, WARREN H., COPHER, G. H., and MOORE, SHERWOOD. Cholecystography: The use of phenoltetraiodophthalein. *J. Am. M. Ass.*, June 19, 1926, lxxxvi, 1899.

The sodium salt of phenoltetraiodophthalein (the isomer of tetraiodophenolphthalein) has been administered intravenously to 50 patients; and for purposes of intravenous use in cholecystography, it seems to possess very decided advantages over anything else hitherto employed. Satisfactory gall-bladder shadows can be obtained with smaller doses; its use therefore is accompanied by fewer and much less severe toxic reactions. The average intravenous dose given was in amounts of 0.04 gm. per kilo; adults receiving up to 2.5 gm. The dye is administered in one dose dissolved in 30 c.c. freshly distilled water.

In 50 cases there were but 3 instances of slight dizziness of no more than ten minutes' duration; and no instance of thrombophlebitis occurred in this series. A final advantage lies in the fact that this substance seems to be more rapidly excreted through the liver, and accordingly the time necessary for a cholecystographic examination can therefore be shortened. Excellent shadows of the gall-bladder may usually be obtained in four hours after the injection.

Only indifferent success with this substance was obtained when administered orally. In the authors' experience the method of intravenous injection continues to give a diagnostic accuracy of 97 per cent as compared with an accuracy of only about 75 per cent with the method of oral administration. Only about 3 per cent of the dye is excreted in the urine even with normal persons, hence the compound appears to be of little use for studying renal function.

The decided advantages possessed by phenoltetraiodophthalein over tetraiodophenolphthalein for purposes of cholecystography have caused the authors to substitute the former for the latter in routine use in the Barnes Hospital, St. Louis.

Another substance has been found which gives excellent cholecystograms. This is the sodium salt of tetraiodoisophenolphthalein. Preliminary experiments indicate a marked absence of toxic effects, but it has not been used sufficiently to show if it possesses any advantages over phenoltetraiodophthalein.

Henius, Kurt. Diagnosis with the aid of 40 per cent iodipin introduced into the bronchial tree. *Klin. Wchnschr.*, Sept. 3, 1926, v, 1664–1665.

A report is given of a case in a man aged sixty in whom the differential diagnosis lay between pulmonary tumor and chronic indurative tuberculosis. An attempt was made to outline the bronchial tree with 40 per cent iodipin solution. The ordinary roentgenograms showed in the patient's left lung a large dense shadow with a horizontal fluid level. This seemed to exclude a possible seropneumothorax or such a large cavity containing fluid. After the injection of the iodipin the sharpness of the horizontal line was no more evident and the whole left lung field was overshadowed, most strongly in the middle portions. In the upper left field there appeared to be two small cavities.

Iodipin, 25 c.c., was injected with the patient lying on the left side, but the roentgenogram showed that most of the iodized oil entered the right bronchus while the left bronchus was entered only a very short distance. Bronchoscopy confirmed the fact that there was a marked swelling of the bronchial mucosa at the point where the iodipin stopped in the left bronchus. Further clinical observations in this case confirmed the existence of a lung tumor.

Hess, George H. Sub-pleural fibrolipoma: Report of a case. *Radiology*, June, 1926, vi, 525–527.

The case occurred in a woman aged forty-nine, complaining of shortness of breath upon slight exertion. The roentgen examination disclosed a dense, sharply outlined, spherical mass measuring about 12.5 cm. in diameter located at the base of the left posterior chest between the 5th rib and the 11th interspace. There was no evidence of invasion, and the mass appeared to have its origin on the left side of the vertebral border of the chest cavity. Roentgenographically the mass appeared to be fixed, did not move with respiration, did not pulsate and did not displace the heart shadow. The lung appeared to glide about it during respiration. The patient was re-examined six months later and there was no perceptible change in the size or shape of the mass. The conclusion was that this mass was a cyst on the left chest attached to the left side of the spinal column.

At operation the mass was removed and found to be a subpleural fibrolipoma. Six months following operation the roentgenograms of the chest showed resection of the sixth, seventh, eighth and ninth ribs at the posterior angle on the left side with no evidence of the previously existing tumor, the lungs and mediastinum being normal.

Huenekens, E. J., and Rigler, Leo G. Ostoemyelitis variolosa. *J. Am. M. Ass.*, July 31, 1926, lxxxvii, 295–299.

In a case of suppurative osteomyelitis variolosa there were observed during the acute stage and, appearing almost simultaneously with the eruption of the variola, a group of destructive lesions about the epiphyseal lines of all the long bones and in the body of the first cervical vertebra. This condition occurred in a boy aged four. He was admitted to the hospital suffering from pharyngeal diphtheria from which he made normal recovery, but while he was still weak and had not fully recovered his strength he became very ill again with a moderately severe case of smallpox complicated by the appearance of a pemphigus eruption. Six weeks after the onset roentgenograms of the wrist, elbow, knee and ankle joints showed very striking pictures. There was no abnormality of the articular surfaces but a distinctly destructive process at the end of the diaphysis just at the epiphyseal line. The latter as well as the diaphysial side of the epiphysis was roughened and irregular. The lesion was notable for its perfect symmetry, widespread invasion and localization to the region of the epiphyseal line. The hip was the only large joint that appeared to have escaped this invasion. The lesions in every case were bilateral and almost equal on the two sides. There was marked destruction of the first cervical vertebra with anterior dislocation of the second. The bone lesions were slightly suggestive of congenital syphilis, but the Wassermann reaction was negative. The diagnosis both clinically and roentgenologically was epiphyseal osteomyelitis variolosa.

Repeated roentgenograms were made and showed progressive destruction, then repair. The acute condition of the bones continued for two months after the eruption of the variola disappeared, being accompanied by rise of temperature and by leucocytosis. There was almost complete recovery except for the dislocation of the first cervical vertebra.

Iglauer, Samuel. Use of injected iodized oil in roentgen-ray diagnosis of laryngeal, tracheal and bronchopulmonary conditions. *J. Am. M. Ass.*, June 19, 1926, lxxxvi, 1879–1884.

Injected iodized oil has proved to be an excellent contrast substance for the roentgenography of the larynx, trachea and bronchi. The oil may be introduced by several methods, including injection with the laryngeal

tube, puncture through the cricothyroid membrane, injection through the bronchoscope, insertion of a catheter into the trachea, or the "swallowing" method. The insertion of a specially devised double barreled intubation tube, with a main channel for breathing and a secondary channel for the oil, provides a simple and effective method for endotracheal injection. It may be used in children and in adults.

In order to direct the flow of the oil into a particular area or region of the lung, it is frequently advantageous to inject the bronchi and change the position of the patient under roentgenoscopic control. The normal tracheobronchial tree is beautifully delineated after injection. In the stenotic larynx the extent of the obstruction may be visualized by the introduction of radiopaque substances. Distortion and displacement of the trachea are clearly delineated. Bronchostenosis, lung abscess, cavitation, the limit of pulmonary tumors and bronchopulmonary fistulas are plainly outlined. As a rule endobronchial injection of oil is well tolerated by the patients. Occasionally dyspnea and some fever ensue. Injection is contraindicated in febrile or cachectic patients and in those with cardiac decompensation.

In the literature no reference is made to roentgenography of the larynx visualized by injection. For the purpose of studying the lumen in the stenotic larynx the oil was injected into the larynx and a profile picture was snapped while the oil was flowing through. In several cases the narrowed subglottic region was well delineated. In tracheotomized patients the following procedure was adopted. A finger cot was filled with fluid contrast substance, and a string was tied to each end of the finger cot. A probe carrying a long string was passed through the tracheal fistula into the larynx and out of the mouth. The oral end of this string was then attached to one end of the finger cot, the tracheal cannula was reinserted and the finger cot was pulled into the larynx. By this method the dimensions of the narrowed subglottic lumen of the larynx could readily be demonstrated in the roentgenogram.

Both lipiodol and iodipin have been used by the author. A considerable portion of the injected oil is ejected by expectoration. The remainder is eliminated by absorption. In 2 cases bronchoroentgenography showed remains of the iodipin in the lung five weeks after it had been injected.

JACKSON, CHEVALIER. Chronic nonspecific infections of the lungs. *J. Am. M. Ass.*, Sept. 4, 1926, lxxxvii, 729–736.

The indications for bronchoscopy in the treatment of chronic pulmonary suppuration may be summarized as follows: In chronic pulmonary abscess bronchoscopic aspiration is indicated to prevent stagnation. In all chronic cases natural drainage by cough and ciliary action is insufficient; this is why these cases have become chronic; bronchoscopic aspiration would have been prophylactic. In cases of pulmonary abscess of other than foreign body origin, in which the pediatrician, the surgeon and the roentgenologist deem external drainage advisable, bronchoscopic drainage is not indicated. Sometimes after a thoracotomy the surgeon may call on the bronchoscopist to restore bronchial communication for ventilation and to aid natural upward drainage of secretions from an isolated, sealed-up area of lung; and in other cases to treat residual suppuration areas.

Many cases of chronic lung suppuration in children have resulted from mistaking the asthmatoid wheeze of foreign body for bronchial asthma. In every case of pulmonary suppuration foreign body should first be excluded. It is also just as important in a case of lung suppuration to exclude foreign body in the esophagus as in the air passages. When a foreign body is present, peroral bronchoscopic removal is the only method of treatment worth serious consideration.

Many of these chronic cases are preventable. The etiological factors are: stagnation of pus in acute and subacute suppuration; the overlooking of foreign bodies in the lung; the overlooking of foreign bodies in the esophagus; and the overlooking of complications of tonsillectomy. Fifteen illustrative cases are cited.

For the purpose of differential diagnosis between chronic bronchitis, abscess, bronchiectasis, spirochetosis, neoplasm, bronchial stenosis and other conditions, the bronchoscope is absolutely invaluable, and in many cases it is the only means by which a positive diagnosis can be made. The bronchoscopic insufflation of bismuth subcarbonate will render any part of the tracheobronchial tree opaque to roentgen rays. In some cases it is preferable to use, by bronchoscopic instillation, a few centimeters of lipiodol. The author prefers the bronchoscopic method for the introduction of lipiodol rather than the subglottic methods.

JANSSEN, P. The importance of the roentgen examination in surgical urology. *Klin. Wchnschr.*, Sept. 17, 1926, v, 1770–1772.

No urological examination is complete without the application of a roentgen exploration of the urinary system as a whole and not of just one portion. For this purpose roentgenography is considerably more valuable

than roentgenoscopy. The most careful and refined technique is necessary for the preparation of useful urological roentgenograms. Intestinal artefacts must be eliminated and compression employed in order to obtain satisfactory pictures. Pneumography may yield useful information. The simplest contrast material for the ureter is the bismuth-ureter-catheter. The best fluid contrast substance is 20 per cent sodium bromide for the ureter and 10 per cent solution for the kidney pelvis.

The roentgenogram will disclose the position of the kidney and any congenital or acquired displacement. In addition changes in the volume and shape can be readily noted. A good roentgenogram will disclose differences in density of the parenchyma. In connection with the clinical findings one will be able to form an opinion upon the nature of the urological process present in the kidney. A tumor will disclose visible differences only after it has attained a certain size. The small tumor amenable to operative removal will, however, only be rarely shown in the roentgenogram. The same applies to the kidney abscess; it gives very good pictures after having attained a large size and the larger abscesses with cavities and calcification of contents of walls are especially well depicted. It is only in rare cases that one will be able to make an absolutely definite interpretation of the picture of the kidney parenchyma without taking into consideration the clinical history.

Brief discussion is given of the roentgenographic appearances of concretions in the kidney and kidney pelvis, the shape of the pelvis and calyces in the pyelogram, cystic degeneration, congenital malformations of the kidney and ureter, ureteral stones, bladder stones, shape of the bladder and mechanism of emptying. The relatively rare concretions in the prostate can be readily discovered by means of the roentgenogram. Roentgenography of the urethra is useful not only for the detection of shadow forming foreign bodies but also for determining the details of a stricture where the urethroscope can give only partial information.

Lawson, John D. Report of a case of gastric diverticulum. *Radiology*, June, 1926, vi, 518–520.

The gastric diverticulum was found in a woman aged fifty, who was admitted complaining of gas, sour stomach and colicky pains in the upper right quadrant of the abdomen of at least one year's duration. The roentgen examination showed the esophagus to transmit food normally without signs of cardiospasm. The stomach filled normally, was of the J-type, normal mobility and motility, and of good tone. There was a definite extravasation of the barium mixture beyond the gastric border on the posterior surface at about the level of the esophageal opening. The size of the pouch was approximately 2×3 cm. There was regurgitation of the meal into the esophagus. The duodenal bulb filled normally showing no deformity, irregularity or angulation. The six-hour examination showed the stomach empty but the pouch still filled. Several gall-bladder films showed a rounded contour in the gall-bladder area. The roentgen conclusions were: (1) chronic cholecystitis; (2) the out-pouching from the stomach might be a perforating gastric ulcer or a diverticulum of the stomach. The even contour of the pouch would make the latter diagnosis more probable. At operation there was found cholecystitis, subacute, with stones; subacute appendicitis. The stomach showed no masses or inflammatory processes from the esophageal opening down to the duodenum.

Although the gastric diverticulum was not observed at operation, the surgeons agree that a lesion of this size could easily be overlooked. In this case a very careful search was made but an out-pouching 2 cm. in diameter would be very difficult to palpate unless there were present at the same time adhesions or other evidence of inflammation.

Lewis, Bransford, and Carroll, Grayson. Maneuver to facilitate passage of catheter through a markedly tortuous ureter for securing roentgenograms. *J. Am. M. Ass.* June 12, 1926, lxxxvi, 1833–1834.

A case is described in a woman aged seventy-one, extremely weak and decrepit, in whom it was highly desirable to determine the renal condition. The catheter was readily passed on the left, but on the right side it was obstructed within an inch of the lower orifice. A roentgenogram at this stage showed marked tortuosity and sharp angulation of the right ureter, evidently due to the fact that the kidney was down in the pelvis.

It occurred to the authors that if the pelvis of the patient should be elevated and by manipulation the involved right kidney could be pushed upward into the abdomen, the ureter might be straightened out enough to permit the insertion of the catheter. This was tried and proved successful. The catheter was gradually pushed upward meeting with, but by successive manipulations passing, the several angulations and finally reaching the neighborhood of the kidney pelvis. The sodium iodide solution was then successfully injected and a good pyelogram was obtained showing a pyelonephritic kidney

situated almost within the pelvis and a tortuous and angulated ureter throughout.

Lichty, John A., Wright, F. R., and Baumgartner, E. A. Primary cancer of the lungs. *J. Am. M. Ass.*, July 17, 1926, lxxxvii, 144–153.

Carcinoma of the lungs in the most recent studies shows a much higher incidence than was formerly thought. It has come to be recognized as occurring comparatively frequently; so much so that in the consideration of diseases of the chest, especially of the chronic form, one should always keep in mind the possibility of primary carcinoma of the lungs. There is no agreement as to the cause of this increase, and the authors point out that this increase is not peculiar to cancer of the lungs. A clinical report is given of 8 cases observed in the Pittsburgh Clinic and 9 at the Clifton Springs Clinic. The clinical features discussed are pathology, histogenesis, metastases, symptomatology, physical signs, diagnosis, laboratory observations.

The slowly progressive extension of the physical signs is a striking feature of cancer of the lung, and a roentgenoscopic or stereoscopic examination of the chest showing an irregular shadow should put one in such an attitude that he will use every diagnostic resource before abandoning the idea of a malignant condition in the lungs. In the differential diagnosis the roentgen examination is of the utmost importance. The roentgenoscopic examination followed by flat plates in various positions is very helpful. The growth is progressive, and this will be noted in the examinations if made at intervals of a week or so. A point in the roentgen examination of the cases which has impressed the authors very much is a shadow occupying the greater part of one lung, with light coming through at the apex and also through the costophrenic angle. This of course cannot occur if there is already fluid in the pleural cavity, but in the early stage before the appearance of a pleural effusion, it is quite significant.

Mediastinal enlargements and growths may cause a group of symptoms which at times suggest strongly cancer of the lungs. Unfornately the roentgen examinations are not always satisfactory in these cases, especially if the growth encroaches on lung tissue space. However, in these cases the pressure symptoms resulting from the crowding of the mediastinum are quite significant and wholly different from the chest pains of carcinoma of the lungs. In all of the eight cases in which necropsy was obtained by the authors or in the 3 cases from which tissue was recovered in sputum or by paracentesis the diagnosis was confirmed; and the authors feel reasonably sure that the diagnosis in the other cases would have been verified if necropsy had been obtained.

A tabulation is also given of 25 cases of secondary cancer of the lung.

Manges, W. F. Pathologic changes in lung tissue as the result of foreign bodies of long sojourn. *J. Am. M. Ass.*, Sept. 25, 1926, lxxxvii, 987–991.

An aspirated foreign body in any portion of the tracheobronchial tree will sooner or later cause extensive permanent injury. There is great variation as to the length of time a foreign body may be present before causing extensive changes, but those that interfere with drainage do as a rule cause injury early. The permanent pathologic change is distal to the point at which drainage is blocked. The foreign body is at or distal to this point.

The end results are in the nature of atelectasis, fibrosis, bronchiectasis and chronic abscess, with varying quantities of purulent exudate. Hemorrhage is common; tuberculosis is often suspected but is rarely present. The other lung remains remarkably free from pathologic change. The author believes that many of the one sided chronic basal infections are the result of foreign body regardless of history or of roentgenographic evidence. Such lesions should at least be investigated bronchoscopically and many should be treated in this manner. Seventeen cases are cited as illustration of the various conditions that may be found.

We cannot by means of roentgen rays alone demonstrate the presence of stricture or of granulation tissue or differentiate between pus or other forms of exudate; and we cannot at times actually demonstrate the cavities that are found with the bronchoscope, but we can demonstrate roentgenographically the exact location, size, shape and position of an opaque body and the extent of involvement distal to it. Especially by means of anteroposterior and lateral roentgenograms after insufflation of bismuth subcarbonate or injection of iodized oil through the bronchoscope, the help yielded by roentgenographic study is becoming increasingly advantageous especially in cases of nonopaque foreign bodies.

McCoy, C. C., and Graham, R. S. Experience with cholecystography in cases coming to operation. *J. Am. M. Ass.*, June 19, 1926, lxxxvi, 1899–1902.

In 26 consecutive cases in which operation was done at the Lakeside Hospital, Cleveland, the cholecystographic diagnoses were confirmed

at operation in 96 per cent. In 212 cases collected from the literature, with intravenous administration of the dye, the cholecystographic diagnoses were confirmed in 91 per cent. In cases with the oral administration of the dye the confirmation was more than 80 per cent. The accuracy of cholecystography in detecting gall-bladder disease merits its wide use as a procedure in diagnosis.

Meader, Charles N. Nontuberculous peribronchitis simulating occult tuberculosis. *J. Am. M. Ass.*, July, 17, 1926, lxxxvii, 139–142.

There exists a type of mild, subacute nontuberculous peribronchitis which may produce interference with the patient's comfort and economic efficiency wholly out of proportion to the physical signs detectable on casual examination. It is to be compared with and differentiated from occult tuberculosis, which may produce closely similar symptoms and signs. Such differentiation can usually be made, but only by careful study and evaluation of the entire clinical picture including the roentgen findings and specific tests.

As has been the experience of many, the roentgen-ray and physical findings by no means always agree as to the existence of enlargement of the tracheobronchial and hilum glands. Good stereograms are indispensable in the study of these mild types. In the interpretation, it must be freely recognized that the "normal" limits of accentuation of the bronchial tree are subject to wide differences of opinion and that individual standards must be largely relied upon. In these cases peribronchial thickening of the finer bronchi, marked thickening not extending to the finer bronchi, but accompanied by mediastinal gland enlargement, or thickening of less extent, but accompanied by areas of parenchymal involvement, have been regarded as abnormal. In evaluating the roentgen evidence for or against tuberculosis, lesions predominantly or wholly of the apices have been regarded as probably tuberculous, and of the lower lobes as probably non-tuberculous; irregular ("beaded") peribronchial thickening as probably tuberculous, and uniform thickening as probably non-tuberculous. The appearance of different age in different lesions is presumptive evidence of the tuberculous nature of the lesions; but the recurring attacks of influenza or other acute exacerbations may occasionally produce lesions of apparently different age in the non-tuberculous group. Calcification of lesions has been regarded as probable, but not absolute, evidence of their tuberculous nature.

It is important that these different types of disease be recognized and differentiated because if properly treated they may be greatly relieved, but if untreated they favor the development of more marked and serious involvement. They offer materially different prognoses as to the patient's probable future limitations, and respond to materially different forms of treatment.

Morse, John L. Chronic, nonspecific infections of the lungs and bronchi. *J. Am. M. Ass.*, Sept. 4, 1926, lxxxvii, 736–739.

Chronic, nonspecific, that is, non-tuberculous infections of the lung and bronchi are far more common in early life than is generally appreciated. Physicians are likely to forget that there are such conditions and to think therefore that all chronic pulmonary conditions in infancy and childhood are tuberculous in origin. If these non-tuberculous conditions are kept in mind and due attention is paid to the history of their development, their symptomatology and their physical signs, it is usually easy to distinguish from those due to tuberculosis.

In chronic bronchitis there are very few physical signs. The roentgenogram shows signs of consolidation in tuberculosis, but nothing or little more than peribronchitis in chronic bronchitis. There are likely to be evidences of tracheobronchial adenitis in both. A negative tuberculin test is strong evidence against tuberculosis. A positive test does not prove, however, that the pulmonary trouble is tuberculous, because the positive reaction may as well be due to some small tuberculous focus elsewhere in the body.

Bronchiectasis is seldom due to tuberculosis of the lungs in early life. The pathologic changes are the same as in later life, but usually less marked. Even in fairly marked cases the physical signs of bronchiectasis may be disguised by those of an associated emphysema. The roentgen ray is not of great assistance in distinguishing between chronic bronchitis and a general cylindric bronchiectasis, unless the dilatation of the bronchi is greater than it usually is in early life. It reveals cavities, however, which cannot be discovered by physical examination, and in bronchiectasis secondary to chronic interstitial pneumonia shows a most characteristic picture. Bronchiectatic cavities which are not at all distinct under ordinary conditions often show very plainly after the injection of lipiodol. It does not tell, however, whether the cavity is due to an abscess or to a bronchiectasis.

Chronic bronchopneumonia practically never occurs in childhood unless it is tuberculous in origin. The nearest approach to a chronic bronchopneumonia occurs in rachitic infants with marked deformity of the chest, softening

of the chest wall and weakening of the respiratory muscles. Pathologically the lungs in these cases show a mixture of bronchopneumonia, atelectasis and emphysema. The roentgen ray shows merely evidences of complete or partial solidification. The occurrence of these physical signs in marked rickets is moreover almost pathognomonic. The value of the tuberculin test is important if negative, much less important if positive. The roentgenogram is of no assistance in the diagnosis nor is the white count which is always elevated.

In chronic interstitial pneumonia, unless a secondary bronchiectasis has developed the roentgen ray shows simply the evidences of consolidation of the lung; that is, no more than can be determined by physical examination. If bronchiectasis has developed the picture shown by the roentgenogram is the same as in bronchiectasis from other causes, but modified by the presence of the newly formed cicatrical tissue. Chronic interstitial pneumonia is almost always mistaken for tuberculosis and the roentgen ray is of little assistance in diagnosis because if tuberculosis of the lung did take this form it would give the same picture. The temperature is usually higher in tuberculosis and the course more rapid. The sputum findings and the tuberculin test are important factors in the diagnosis.

In abscess of the lung the physical signs depend on whether the abscess is open or closed, and whether it is near the surface of the lung or not. The roentgen ray is very useful in locating abscesses deep in the lung and it can demonstrate abscesses that cannot be detected in any other way. It also shows whether the abscess is due to a foreign body or not, provided the foreign body is one that casts a shadow. Bronchoscopy is also often of assistance in diagnosis. In interlobar empyema the physical signs are usually most obscure. The most important point is a horizontal strip of dullness in the axilla at about the level of the fourth rib, with normal resonance above and below. The roentgen ray is of the greatest help in the diagnosis of interlobar empyema. It shows plainly what can often only be guessed at or suspected from the physical signs. It renders unnecessary repeated thoracenteses in attempting to determine the location of the pus.

NÖLKE, WILHELM. The roentgen diagnosis of duodenal ulcer with special reference to the direct symptoms; and outline of the examination technique of the Municipal Roentgen Institute (Cologne). *Klin. Wchnschr.*, Oct. 8, 1926, v, 1915–1920.

About 1000 roentgen examinations of the stomach were made within less than a year, and the findings may be summarized as follows: 350 cases were negative; 158 had ptosis associated with atony; 153 had duodenal ulcer (123 men, 30 women). There were 172 cases with pyloric or prepyloric ulcer (128 men, 44 women); there were 26 cases with carcinoma mostly of the pylorus (14 men, 12 women). There were 86 cases with adhesions in the vicinity of the bulbus duodeni (10 men, 76 women).

About 20 of the cases were operated upon, 8 per cent being for duodenal ulcer alone. The gastric roentgen findings were practically all confirmed at operation. Among the duodenal ulcers there was found in one case an epigastric hernia, in 2 others an old pleuritis with adhesions of the diaphragm. In 4 operations, a roentgenologically diagnosed duodenal ulcer was found to be due to slight adhesions to the gall-bladder. This summary may be taken as a fair indication of the reliability of the roentgen diagnosis of duodenal ulcer. The great advantage of the roentgen study is that it also furnishes indications regarding treatment.

In contrast to the gastric picture, the filling of the duodenum is not constant because of the action of the pyloric reflex. The position of the duodenum is moreover anatomically unfavorable for direct examination as compared with the stomach. The indirect distant symptoms of pyloric ulcer are; (1) duodenal motility; (2) right handed position and pyloric fixation; (3) dentation of the large curvature; (4) ptosis; (5) the bulbus filling; (6) hypersecretion, and (7) local pressure pain. The reliability of these indirect symptoms diminishes in the order given.

The direct symptoms of duodenal ulcer depend of course upon the anatomical changes in the wall. There may be distinguished three main types of change: (1) the fresh mucosal ulcer; (2) the callous penetrating ulcer, and (3) the ulcers associated with scars caused by periodic healings. The fresh mucosal ulcers, which are frequently overlooked even at operation, show very few objective roentgenological signs. This type of ulcer usually produces rather mild symptoms, and such cases do not often appear for examination.

The majority of cases are those suffering from chronic recurrent callous ulcer with deep crater and the well-known symptoms. Such ulcerations which usually traverse all the layers of the intestinal wall and occasionally penetrate neighboring organs are associated with a fairly stiff, infiltrated intestinal wall and give corresponding roentgenological pictures which are striking. The third type of ulcer associated with old scar formation will disclose

alterations in the configuration of the intestines due to scar contractions and in addition a tendency to stenosis will give indications in the form of altered tone, peristalsis and motility of the stomach which cannot be mistaken in the roentgenographic picture.

The author gives a description of the technique of roentgenoscopic study followed at the Bürgerhospital in Cologne, and discusses the typical roentgenographic pictures of the normal and ulcerated duodenum.

Ober, Frank R. Diagnosis in orthopedic surgery. *J. Am. M. Ass.*, June, 12, 1926, lxxxvi, 1813–1815.

The orthopedic surgeon of today is well trained in the application of therapeutic measures to prevent and relieve deformity, but he is often faced with problems which have not been properly analyzed or which have been solved only after considerable injury has been done to important structures. Some of the reasons for this are wrong diagnosis, late diagnosis, snap diagnosis or the diagnosis of hysteria. Most weaknesses in solving problems in diagnosis are due to (1) bad elementary training; (2) insufficient knowledge of the fundmental subjects in medicine; (3) lack of proper hospital training; (4) incomplete physical examination; (5) failure to make a thorough search for the cause of the ailment; (6) premature selection of a specialty, and (7) dependence on the roentgen ray alone.

Dependence upon the roentgenographic evidence for making a diagnosis is a fault in a good many clinics and has been the cause of a good deal of harm. In the first place, pathologic changes may be present for many days or even weeks before the roentgen ray will reveal them. In the second place there are so many lesions that give similar appearances in the roentgenogram that a precise diagnostic interpretation cannot be made. The roentgenogram is a valuable aid in diagnosis; so is the clinical thermometer; but no one would think of depending on the latter alone for a diagnosis.

There are four diseases which are often diagnosed late and which are responsible for more cripples than all the other orthopedic conditions combined. They are acute osteomyelitis, acute poliomyelitis, bone and joint tuberculosis, and chronic arthritis. In acute osteomyelitis the roentgen-ray findings are of no value for early diagnosis. Poliomyelitis should if possible be diagnosed in the preparalytic stage, which can be done in most cases. The early signs are mental irritability, stiffness of the neck and headache. In arthritis the prodromal signs and symptoms are too often ignored or treated with a few doses of acetylsalicylic acid, when active measures will check them or even result in a cure. The examination of such patients should not stop with infected teeth and tonsils, and a great deal of attention should be paid to the gastrointestinal tract. Barium meals may be necessary, and an examination of the stools should always be made.

When joint tuberculosis is suspected a thorough history should be taken and an examination made to determine whether or not there is a primary focus. Such an examination should include a roentgen examination of the chest, a tuberculin intradermal test and also a focal tuberculin test. Roentgenograms of the joints should be taken, and when the evidence is not sufficient a biopsy should be done.

Ohm, Reinhard. Roentgenographic observations upon the motility of a shell splinter in the right auricular wall as indicating a direct suction effect of the human heart chambers. *Klin. Wchnschr.*, Oct. 13, 1926, v, 1968–1969.

By dorsoventral illumination there was seen in the lower quadrant of the heart shadow lying upon the right auricle a shell splinter shadow about the size of a cherry pit, which remained within the heart shadow at least 1 cm. to the left of the right or posterior boundary of the heart when observed from different angles. The fragment moved synchronously with the radial and carotid pulse toward the left and downward in an arc about 2 to 3 cm. long, slightly convex downward and returning to its original position in a straight line during ventricular diastole. With the patient holding his breath, the excursions were very distinct and had the form of a uniform pendular movement. Preceding the swing to the left or at the end of the right swing, i.e., preceding systole, or the end of diastole, there could be observed a very slight upward quiver of the fragment. Simultaneous observation of the fragment and the heart apex revealed the fact that these two points approached each other during ventricular systole. Illumination through the first oblique diameter, placing the shadow of the fragment posteriorly to the right reveals the movement to be in a straight line toward the left with an inward movement of the apex at the same moment. In this case the extent of excursion appeared to be somewhat greater than in the sagittal view. In short, the movement of the splinter is toward the left anteriorly and synchronous with the ventricular systole. Its position may be described as low down on the internal wall posteriorly to the right. The observations in this case give an idea of the power of the direct

suction effect of the heart chambers. The observations confirm those seen in the exposed animal heart in which the suction effect is produced by the base of the ventricle moving toward the apex.

Pritchard, Stuart; Whyte, Bruce, and Gordon, J. K. M. Use of iodized oil in diagnosis and treatment of bronchial affections. *J. Am. M. Ass.*, April 10, 1926, lxxxvi, 1119–1123.

By injections of iodized oil into the bronchial tree, small bronchiectatic dilatations in and around the roots of the lungs, and cylindric, fusiform enlargements of the descending branches which have escaped discovery in the ordinary chest examination may be revealed in many cases of chronic cough. The entire bronchial tree cannot be visualized with one injection. Small sections of the lung should be injected and studied until any abnormality is discovered or until the entire field is explored.

The nose and throat should be studied in all cases. Bronchiectatic cavities occur as the result of chronic upper respiratory infections, and may continue to cause cough after the tonsils are removed or the sinuses drained. The authors feel that in the majority of cases the subglottic method of injecting the iodized oil into the lung roots and descending branches of the bronchial tree takes less time, less anesthesia, is less worry to the patient and gives results as satisfactory as by other methods. It is not necessary to use extensive local anesthesia in most cases.

In more than 600 bronchial injections of iodized oil the authors have seen no ill effects in their patients. No cases of iodinism occurred. In acute affections or pulmonary tuberculosis one should hesitate to inject iodized oil for either diagnostic or therapeutic purposes.

Negative results of an injection are no diagnostic proof that bronchiectatic dilatations do not exist. As a result of the slow liberation of the iodine from the iodized oil in the bronchial tree, this material acts as an ideal treatment in chronic affections of the lower respiratory tract.

The iodized oil employed by the authors is the poppy seed oil containing 40 per cent iodine such as described and used by Forestier under the name lipiodol. The patient's position during injection is important as the distribution of the oil is determined by gravity and the aspirating power of the lung. The inferior lobes are most easily injected with the patient sitting. The oil is directed to the right or left bronchus by inclining the patient slightly in the corresponding direction during injection. The middle and upper lobes can be injected only when the patient is lying down and with this position the supraglottic method is still effective, but the transglottic, the subglottic and the bronchoscopic methods may be used. To fill the apical bronchi the patient should be placed on a tilting table with the desired side downward. A few seconds after the injection the head of the table is lowered for a minute to permit the oil to flow into the upper lobe. Two cases are cited.

Richter, H. M. Cholecystography. *J. Am. M. Ass.*, March 27, 1926, lxxxvi, 937–938.

The inherent dangers of cholecystography must be quite fully appreciated. One of them is that it fosters a tendency to think in terms of late pathologic changes; another is that the normal roentgenogram is likely to direct attention away from the actual source of trouble. That cholecystography is intrinsically of great value has been amply proven, especially in patients with advanced gall-bladder disease in whom the clinical history is atypical or difficult to obtain.

During the terminal stage of the evolution of gallstones the new roentgenographic evidence is of great interest, undoubtedly accurate when positive, and often of great value. During the years before the terminal stage is attained the method becomes decreasingly accurate, for with less advanced changes in the gall-bladder wall and cystic duct lumen, the dye may reach the gall-bladder readily, and the concentrating function and contractility may be but partially impaired. However, when the clinician visualizes gall-bladder disease in terms of early pathologic changes, chronologically at the period of early symptoms of extragastric dyspepsia, when the alert physician really wishes to make a diagnosis, and often can do so on the history alone, we find that not only must cholecystography fail, but the beautifully clear cut roentgenogram of the typical normal gall-bladder actually directs the attention away from it as the source of trouble.

Sante, L. R. First infection in pulmonary tuberculosis. *Radiology*, June, 1926, vi, 504–508.

Apical lesions increase in frequency with the age of the individual; rarely are apical lesions found before ten years of age. In the adult the tuberculous infection starts in the apex. It either progresses by bronchial extension or heals with fibrosis. There is little tendency to involve the regional lymph nodes and caseation rarely occurs. The apical lesions of adult tuberculosis which tend to heal by fibrosis are secondary infections occurring in individuals previously infected during childhood in which the primary

lesion may have entirely disappeared or shows only a small calcified deposit.

The roentgen diagnosis of pulmonary tuberculosis is a purely anatomical diagnosis of lung involvement; if pleural thickening alone is present unaccompanied by parenchymatous roentgen findings, it can be called nothing more than a thickened pleura, but if it is accompanied by parenchymatous findings in its vicinity it must be considered as a part of the pathological process. The presence of a thickened interlobar pleura is by no means characteristic of incipient tuberculosis any more than Dunham's "fan" is a specific indication of this disease.

In an effort to determine the frequency of interlobar pleural thickening in patients with incipient tuberculous lesions, a study was made of 339 incipient cases occurring in 1000 consecutive cases of tuberculosis. In anterior roentgenograms of the chest made with ordinary technique without reference to demonstration of the interlobar area, thickening of the interlobar pleura was found in approximately two-thirds of the cases. Since the technique used was favorable only for showing the interlobar pleura between the middle and lower lobes on the right side, if only right-sided involvement were considered, a greater percentage of positive findings would have resulted with more suitable technique.

The adult type of tuberculosis occurs at the periphery of the lung where the bronchial and pulmonary circulations mix. Lymph drainage from this area is in two directions: one toward the hilum region giving rise to the appearance of Dunham's "fan;" and the other toward the pleura giving rise to thickening of the pleura in the region involved and in the interlobe. Thickening of the interlobar pleura is obviously not pathognomonic of incipient tuberculosis but if other possible causes can be ruled out, it is of distinct significance when associated with questionable incipient lesions in the apex.

Schönfeld, Herbert. The roentgenological differential diagnosis between hernia and diaphragmatic relaxation. *Klin. Wchnschr.*, Sept. 3, 1926, v, 1657–1660.

Observations show that in the case of a very large defect of the diaphragm the hernial sac can appear in the roentgenogram as a uniform domed curve extending from the mediastinum to the lateral thoracic wall and from the vertebral column to the sternum, *without adhering to the contours of the projected* abdominal organs so that the defect may imitate completely the characteristic picture of the *diaphragmatic arch*. On the other hand, it is entirely possible theoretically that in a case of relaxation a paper-thin, entirely relaxed diaphragmatic sac may mantle the subjacent abdominal organs in a manner analogous to the hernial sac. In fact such a case was found at autopsy by Glaser in 1903. In such a case the roentgenogram would disclose the contours of the diaphragm and thus lead to an erroneous diagnosis of hernia.

From the above considerations it is clear that the presence of a uniform arch or the appearance of a broken outline is only of conditional value as a differential diagnostic character distinguishing between hernia and relaxed diaphragm. This merely emphasizes the fact that it is difficult to base generalizations on single characters and that interpretation should take into consideration all the facts possible.

A report is given of a case of congenital, true diaphragmatic hernia in which the usual reliable roentgenological characteristics were absent. During the roentgen examination the diaphragm always showed a uniform arched appearance both in the upright and recumbent positions. The tentative clinical diagnosis was relaxed diaphragm. The infant died of bronchopneumonia and the autopsy disclosed a true diaphragmatic hernia with crowding of the thoracic organs upward and to the right.

Shelden, Walter D. Secondary tumors of the brain. *J. Am. M. Ass.*, Aug. 28, 1926, lxxxvii, 650–654.

Approximately 5 per cent of the brain tumors examined at the Mayo Clinic are metastases from malignant disease elsewhere in the body. These metastatic tumors present no essential characteristics which distinguish them from primary tumors of the brain.

A roentgen examination of the lungs and head is very important when evidence of secondary tumors is sought; and such reports as healed tuberculosis, miliary tuberculosis, pleural adhesions, pneumoconiosis and pleural effusions should be received with reserve and examinations should be made at sufficient intervals to determine whether these signs remain constant. Primary carcinoma of the lung is particularly prone to metastasize to the brain and meninges and to the bones of the spine.

A roentgenogram of the head seldom gives evidence of secondary tumors in the brain although the skull is quite often invaded by metastatic tumors, notably by hypernephroma. Suspicious signs in the bones of the chest or skull, themselves not diagnostic should lead to further study of the osseous system for more positive data. Carcinoma of the nasopharynx often invades the skull, and its first clinical symptoms may be ocular palsy, chias-

mal signs or involvement of the fifth and other cranial nerves.

For instance, in hypernephroma when the tumor is small or located peripherally it may exhibit no signs or symptoms and the various examinations may be negative. A primary tumor with metastasis in the brain may be entirely missed. Roentgenograms of the chest and skull should be taken as soon as symptoms suggesting brain tumor appear both for their immediate value and for comparison with later studies.

Two illustrative cases are cited in detail. In addition there are tabulated three groups of metastatic tumors of the brain. Group I, consisting of 10 cases, includes latent malignant disease, the initial symptoms of which were due to cerebral metastases. The importance of the roentgen examination of the chest in these cases is emphasized. Group II includes 6 cases of malignant disease which were symptomless, but demonstrable on examination. The initial symptoms in these were cerebral. In this group are included three cases of carcinoma of the nasopharynx and 2 cases of carcinoma of the thyroid. Group III includes 8 cases in which the malignant tumors were removed surgically, and the cerebral symptoms were the first evidence of recurrence. Three of the cases developed following removal of breast carcinoma and one each from carcinoma of the sigmoid, hypernephroma, sarcoma of the testis, malignant mole and tumor of the parotid gland. There is still another group of malignant disease which during its clinical course metastasizes to the nervous system with or without the production of definite symptoms.

SIMPSON, FRANK E., and FLESHER, ROY E. Radon (radium emanation) as a palliative agent in the treatment of intra-oral cancer. *J. Am. M. Ass.*, Aug. 28, 1926, lxxxvii, 655-657.

The usual technique employed by the authors is as follows: If only surface irradiation is to be given, approximately 1000 mc. screened with 2 mm. silver and 2 mm. rubber is applied to an area 4 to 6 sq. cm. for fifteen minutes. Great care must be taken not to rub or traumatize the lesion. Sometimes a lesion is of such irregular contour that several applications are necessary, and in these cases due regard must be paid to overlapping. If intratumoral treatment is also indicated a preliminary surface irradiation is given with 1000 mc. in order to minimize the danger of metastasis. This procedure is regarded as very important. Then bare glass tubes are implanted under local anesthesia, each tube containing 0.5 to 1.0 mc. of radon, the tubes being distributed 1 cm. apart, evenly throughout the lesion. These are allowed to remain since the tubes either become encysted or slough out during healing. A small piece of tissue for microscopic examination is removed with a small sharp punch immediately after the first powerful irradiation.

To guard against local effects on the fingers the radon tubes are handled with rubber covered forceps 12 inches long. The operator during the application of the radon is shielded from the patient by movable lead angle plates each weighing about 300 pounds. The lymphatic glands of the neck of the patient frequently require irradiation, and the radon is applied by means of wooden carriers $4 \times 4 \times 4$ cm. For the protection of the patient a heavy movable lead shield is employed which fits around the wooden block carrying the radon and is suspended above the table on which the patient lies.

Between 1919 and 1922 the above radon treatment was employed in 56 unselected cases of intraoral squamous cell cancer, none of the cases being favorable for operation. The clinical diagnosis was confirmed microscopically in all of these. There were 52 men and 4 women. The average duration of the disease was 5.3 months. The lesion was on the tongue in 9 cases, on the floor of the mouth in 3, and buccal mucous membrane in 17, the superior maxilla in 8, the inferior maxilla in 7 and the palate and tonsil in 12. In 29 cases there were palpable lymph nodes in the neck; in 23 the submaxillary nodes were apparently affected and in 4 the cervical nodes. One case had palpable submaxillary and submental nodes; in another there were palpable submental and cervical nodes. In 27 cases no definite nodes could be detected.

Thirty-nine of the 56 cases have been carefully traced. Of these 21 had definitely palpable lymph nodes when treated. Of these 2 are living, one having been well for over five years and the other for over four years. The remainder died but the majority showed definite improvement for a time. The duration of life after treatment varied from four months to three years, average 16.4 months.

Of the 18 patients without nodes 14 are living, 4 for more than five years, 5 for more than four years, and 5 for more than three years. Four of the patients are dead. Three of the latter lived for more than three years after treatment but all died eventually of recurrence.

Of the 9 patients with tongue cancer 6 had palpable nodes in the neck, and 2 of these are living. Of the 3 patients without nodes, 2 are living. The 4 living patients with tongue cancer have been well for five years, four years, three and a half years and three years respectively.

Assuming that the 17 untraced patients are dead, the total mortality in this group of 56 unselected patients is 63.3 per cent. The remainder have been well for periods of three to five years, the average duration of freedom from symptoms of cancer being three years and nine months up to the time of this report.

Stockman, Ralph. Ossifying spondylitis. *Edinb. M. J.*, October, 1926, xxxiii, 597–605.

Ossifying spondylitis is a condition due to various infections which irritate fibrous tissue and induce a more or less general fibrosistis of muscles and joints throughout the body. In the spine and costovertebral articulations and much more rarely in the peripheral joints, the ossification gradually takes place in the inflamed fibrous tissue for some unknown reason and as time goes on the bones of the vertebrae rarefy from partial disuse.

The cases of ossifying spondylitis seen by the author developed chiefly in persons who had suffered previously from acute rheumatism, chronic muscular rheumatism (fibrositis and panniculitis), infective arthritis, Still's disease, gonorrheal rheumatism, dysentery, mucous colitis and non-tuberculous chronic lung infections, all these being conditions which give rise to chronic inflammations of the connective tissues. Brief reports are given of 2 cases after prolonged muscular rheumatism, one from gonorrheal rheumatism, one from dysentery, 2 from infective arthritis, one from chronic lung infection, 2 from injury and one from prolonged immobilization of the spine.

A study of typical cases shows that the bony deposit is preceded by an inflammation of the fibrous tissues which for some unknown reason took on the formation of bone. In some of the cases of rigid spine the most careful and repeated roentgen examinations failed to reveal any bony deposit, and in these it can only be concluded that the rigidity was due to fibrositis and muscular spasm. All of the cases reported had well marked spondylitis showing to a greater or lesser degree the secondary results of the condition. The lesion was never confined to the spinal column, but in every case some of the joints were stiff and there was always more or less generalized fibrositis.

Sutherland, Charles G. Polypoid tumors in the pyloric end of the stomach: Reports of three cases. *Radiology*, June, 1926, vi, 520–522.

The first case occurred in a woman aged sixty complaining of "stomach trouble" of one year's duration. Examination revealed a movable, tender mass in the right flank supposed to be a kidney. A roentgenogram revealed a large shadow in the area of the right kidney at the level of the fourth lumbar vertebra, and cystoscopic examination showed the function of the right kidney to be greatly impaired. Roentgenoscopy elicited a narrowing of the antrum of the stomach, pre-pyloric spasm so frequently associated with gastric ulcer, and the films presented a saucer shaped defect in the duodenal cap. At operation a soft movable tumor about 6 cm. in diameter was found at the pyloric end of the stomach. This tumor could be invaginated into the duodenum. The patient also had a gastric ulcer on the lesser curvature, about 7.5 cm. above the pylorus. The right kidney was resected at a later operation when a pyonephrosis with stone was found.

The second case occurred in a man aged fifty-one complaining of anemia and weakness in the legs. The patient had five years previously received treatment for *Entamoeba histolytica* infection. Roentgenoscopic examination of the stomach elicited an obstructive lesion in the pyloric end. This defect in the pylorus had a smooth margin, no shelf was elicited and there was no palpable mass. The operation disclosed a polyposis associated with multiple ulcerations in the pylorus just above the pyloric ring. The involved area was resected and convalescence was uneventful.

The third case occurred in a man aged sixty-one who complained of anemia which had lasted three years. Roentgenoscopy revealed an interesting filling defect in the duodenum. The barium was occluded by a tumor and presented a picture of fine trabeculations running in various directions across the cap. A diagnosis of benign tumor was made. At operation a movable, adenomyomatous polyp was found arising from the stomach just at the pylorus and invaginated into the duodenum. The tumor occluded the greater portion of the barium but left the contour of the duodenum intact. It is remarkable that this patient had no history of obstruction or impaction.

Taylor, Henry K. Periosteal changes in a case of lymphatic leukemia. *Radiology*, June, 1926, vi, 523–525.

A report is given of a case occurring in a child aged two years, ten months. The present illness dated back seven months when the child began to complain of an inability to walk. The roentgen findings of all the long bones including the metacarpals and metatarsals showed a slight elevation of the periosteum with some productive changes. There was no evidence present either clinically or roentgenographically to suggest rickets, scurvy or syphilis. The child

died two months after admission and the autopsy revealed marked general anemia and moderate enlargement of the spleen with complete absence of the Malpighian follicles. There was moderate hyperplasia of the lymph nodes with striking hyperemia of the lymphatic tissues. A section taken from the right tibia showed a lymphatic infiltration underneath the periosteum and replacement of the bone marrow. The post mortem findings verified the diagnosis of chronic lymphatic leucemia.

THOMS, HERBERT. The clinical significance of x-ray pelvimetry. *Am. J. Obst. & Gynec.*, October, 1926, xii, 543–550.

In the author's method of roentgen pelvimetry the position of the patient must be maintained so as to make the superior strait parallel with the roentgen plate. The second factor is the determination of the degree of divergence from the vertical which the roentgen rays undergo in passing from the tube through the superior strait to the film. In order that the distortion produced may be equal in all directions, the tube must be centered over the superior strait and the plane of the superior strait must be parallel to the sensitive film underneath. These conditions are fulfilled when the patient is placed in semirecumbent position with the back arched. To determine the level of the superior strait, it is necessary to identify two points on the external surface of the body. These are located one on the anterior surface of the symphysis 1 cm. below the superior border and posteriorly at the depression just below the spine on the fourth lumbar vertebra. An imaginary line connecting these two points traverses the anteroposterior diameter of the superior strait. It is essential therefore that these points shall be at equal distances from the roentgen film.

Based on the above, the author presents his method of roentgen pelvimetry, by means of which the dimensions of the superior strait can be measured with remarkable accuracy. The method is applicable in any stage of pregnancy and does not require elaborate apparatus. It is also possible to obtain lateral views of the pelvis showing the contours of the sacrum and the relation of the presenting part to the superior strait. Attention is drawn to the value of such information in the diagnosis of less severe grades of rachitic pelvic deformity.

VALENTI, ALESSANDRO. Roentgen findings in regard to the filling and emptying of the vermiform appendix. *Radiol. med.*, July, 1926, xiii, 504–512.

Valenti, in studying the filling and evacuation of the vermiform appendix in 2 cases which were controlled surgically, concludes that slow emptying of the appendix may be a reason for its not appearing sometimes in the roentgen picture. This slow emptying may be due to disturbances of its motility without there being any real anatomical change, analogous to hypomotility of other parts of the digestive tract, as a result of conditions of atony or hypertonia from any cause whatever. By patient, repeated examinations of the appendix with special technical devices the great majority of appendices, normal or diseased, may sooner or later be rendered visible.

VIETTI, MARCO. Ascarids and ascaridiasis. *Radiol. med.*, August, 1926, xiii, 546–557.

Vietti describes the roentgen appearance of ascarids and discusses his conclusions from 65 cases in which they were found. In 17 of the cases the disturbances were to be attributed solely to the ascarids, in 20 the ascaridiasis coexisted with other more important causes of disease and in the rest the ascarids were a chance finding in disease due to some other cause. While these parasites may cause disease they are often quite harmless. They have a special predilection for narrow canals such as the common bile duct, the pancreatic duct, the appendix, etc., and in these locations cause symptoms that cannot be distinguished from those of calculosis or appendicitis from other causes. A case of paralytic ileus is described in a man aged sixty in whom roentgen examination showed ascaridiasis and when the worms were expelled by anthelmintic treatment he promptly recovered. Ascarids may also cause a syndrome resembling that of gastric or duodenal ulcer and may cause various vasomotor, secretory and nervous disturbances which however are not peculiar to ascaridiasis but may be due to irritation from other causes.

A case is described in which large numbers of ascarids were expelled from the intestine by anthelmintic treatment and a few days afterwards the tract of jejunum that had contained the parasites showed a diffuse delicate coating of barium. This segmental persistence of slight traces of opaque substance is interesting as a sign of fine changes in the parietal nervous mechanism; while the motor function of the muscular coat is unchanged the function of the muscularis mucosa is decidedly disturbed.

But diagnosis must not be made from the presence of ascarids alone but by a systematic exclusion of the other pathological conditions which might cause the symptoms of which the patient complains. In general ascaridiasis should be the last possibility considered. In illustration a case is described in which roentgen examination showed an ascarid in the bulb

of the duodenum and one in the second portion with symptoms of ulcer of the duodenum; there were no signs of deformity of the bulb or the other characteristic changes of ulcer, and as many ascarids were seen in the jejunum it was thought that the symptoms of ulcer were caused by the parasites. Anthelmintic treatment was given and the worms expelled but a month later the patient presented melena and had more acute ulcer pain. The author does not believe that ascarids cause true ulcer but thinks that when ascarids coexist with signs of ulcer another roentgen examination should be made after the parasites are expelled. Two other cases are described, one with symptoms of ulcer of the stomach and the other of ulcer of the duodenum, in which the symptoms disappeared completely after the anthelmintic treatment and later roentgen examination did not show any signs of ulcer.

VON FRANQUÉ, OTTO. The radiation treatment of genital carcinoma. *Strahlentherapie*, 1926, xxi, 187–221.

The treatment of choice for carcinoma of the uterus is not so clearly established as in the case of mammary carcinomas, but present day statistics seem to favor radiation therapy over surgery. There are, however, certain clinics in which unfavorable results with radiation have caused a return to surgical methods, but it is pointed out that improper radiological technique, mainly overdosage, has been responsible for the alleged failure of the radiation treatment. Experience to date shows that about 6000 radium element milligram hours on the average is required to effect cure of a carcinoma. In the Bonn Clinic about 6000 to 7000 mg-hr. is employed and the Radium Institute in Stockholm administers 6700 mg-hr. In Stuttgart a dose of only 3600 mg-hr. was given, a quantity inadequate for the complete treatment of the average case. It appears that the radium dose employed in America is, on the average, somewhat low: Greenough's data are quoted showing that 22 American hospitals used on the average 5000 mg-hr. of radium.

It is the author's present belief that the radiation treatment of operable tumors is on a par with surgery so far as end results are concerned. The three main essentials of a satisfactory radiation treatment are an avoidance of underdosage, of overdosage and of premature termination of treatment. The improvement that usually occurs in two to three months, namely, cessation of hemorrhage and increase in weight, all these are not signs of cure and the necessary continuation of the treatment should be pursued. For this reason treatments should be given at such close intervals that there will be no tendency for the patient to be neglectful and the recent aim has been to attempt a full dose at the first treatment. One hundred mg. of radium element is employed by the author, and this is administered twice for periods of thirty-six hours, the whole applicator being completely intracervical. In addition, a complete roentgen treatment is given through large fields in the abdomen, back, both sides and through the vulva. The usual precautions should be taken against injuring the rectum and bladder. In addition, the temperature and other symptoms of the patient should be carefully followed and the radium promptly removed if necessary.

If a thrice repeated radium irradiation produces no results, it must be concluded that nothing can be expected from the radium; and a repetition of the treatment before the lapse of six months will only prove harmful. Should the case be of the operable type, surgery is indicated. The roentgen treatment is repeated, depending on the findings in the pelvis and on reaction of the skin, three to six months after the first roentgenization, especially when a radium application is no longer or not yet possible, and the symptoms indicate the desirability of continuation of the treatment.

The radiation treatment has a mortality hazard also, but it is slight, the figure being about 1 per cent, on the average, among European clinics. Through the introduction of the radium, especially in the cervix and the cavum uteri accidental injuries are produced or septic organisms are forced through the tubes into the peritoneum, thus causing infections leading to the mortality above mentioned.

The value of radiation therapy after operation is recognized and practiced in the Bonn Clinic, and roentgen rays are used practically exclusively for this purpose since after-irradiation with radium is very dangerous. In cases, where combined roentgen and radium therapy was employed, each form of radiation was administered in full dose, that is 6000 to 7000 mg-hr. were given and deep roentgen therapy was also given through five fields, a total of 100 to 120 per cent of the skin erythema dose being delivered at the site of the tumor. In earlier days this roentgen dose corresponded to 780 to 870 R but more recently, it has been increased to 1000 to 1200 R. This roentgen dose has occasionally caused pronounced symptoms of intestinal irritation but they have never been serious. In the future, it will no doubt be necessary to attempt some sort of quantitative relation between the roentgen and radium doses in treatment.

The above comments have been made with

special reference to the most frequent and dangerous form of carcinoma of the uterus, namely, cervical carcinoma. Carcinoma of the body of the uterus which has excellent prospects after surgical treatment has been regarded by many as less suitable and promising for radiation treatment. This view is not shared by the author who believes that carcinoma of the body of the uterus if not too far advanced or involving the whole thickness of the organ is curable by radiation with more certainty than is even cervical carcinoma. It is of course not easy to determine how deep the cancer has extended into the wall and it is therefore advisable to operate in those operable cases in which the uterus is very much enlarged or where other symptoms indicate operation. However, in early cases the author's experience shows an excellent prospect for permanent results with radiation therapy.

An opinion is expressed against the use of radium seeds. This technique is not very promising in the field of genital carcinomas since the usual application of radium is so convenient and practically without danger. On the other hand, the insertion of seeds is technically not so simple and is also necessarily accompanied by a certain amount of hazard such as follows test excisions.

WEINBERG, EDWIN. Osteomata of lower end of tibia. *J. Bone & Joint Surg.*, July, 1926, viii, 562–564.

Roentgenographically osteomas assume a cauliflower shape and are characterized by a large amount of new bone laid down in a symmetrical manner with a very definite order and with no evidence of invasion. On the long bones, they are commonly found at the inner and upper end of the tibia and inner and lower part of the femur. They show no tendency to malignancy nor do they recur after removal.

Brief reports are presented of 3 cases in which osteomas occurred at the lower end of the tibia causing a distinct thinning of the shaft of the fibula by mechanical pressure.

WOLFSOHN, JULIAN M., and MORRISSEY, EDMUND J. Tumors of the cauda equina. *J. Am. M. Ass.*, June 12, 1926, lxxxvi, 1828–1831.

Tumors of the cauda equina are more common than supposed. In the early cases roentgen examinations of the lumbosacral region and lumbar puncture are usually negative. The most valuable auxiliary for accurately localizing spinal block lies in the introduction of from 2 to 3 c.c. of lipiodol into the cisterna magna by Sicard's method. With the patient in a sitting posture the oil rapidly passes into the spinal subarachnoid space and is checked at the level of the block which can then be clearly visualized by the roentgen examination with the patient erect.

Two cases are reported of cauda equina tumors illustrating delayed and inaccurate diagnosis. The first patient was treated for Pott's disease, and suffered for thirteen years before a correct diagnosis was made. His subjective symptoms most of this time pointed to a caudal disease, and subsequent diagnoses were most probably colored by the previous erroneous diagnosis. The second patient presented a suggestive caudal lesion: burning pains in the perineum, radiating pains, increased by recumbent posture and relieved by walking, and severe constipation which were absent before the present illness. This is a suggestive and important triad of caudal symptoms which this patient presented for about two and a half years. Both patients presented few neurological findings. The diagnosis of caudal lesion was made pre-operatively in each case and confirmed by the intrathecal injection of lipiodol which accurately localized the upper level of the lesion. Both these cases conformed in a general way to Type II (middle type syndrome of Roussy and Lhermitte). In the second case, xanthrochromic spinal fluid was found below the tumor at operation and above the tumor as high as the cisterna magna. This confirms the observation of Cushing and Ayer.

ROENTGEN AND RADIUM THERAPY

BÉCLÈRE, A. Successful roentgen treatment of a pulsating apparently sarcomatous neoplasm of the sacrum. *Strahlentherapie*, 1926, xxi, 561–566.

The case described, occurring in a girl aged thirteen, is a striking example of the remarkable effects of roentgen therapy on certain neoplasms of the osseous system, especially the spinal column.

Four months previously the child suffered a painful fall upon the buttocks. After this accident increasing painful symptoms developed in the legs and over the sacrum. After a while the original site of trauma developed a pulsating tumor which was painful. A test puncture of the tumor revealed pure blood and no signs of abscess. The roentgenogram of the pelvis showed the iliac bones practically normal and almost complete absence of the shadow of the os sacrum except for one or two shadows remaining in the median line. This indicated that if there was no destruction of this

bone there was at least almost complete decalcification.

The various symptoms and the course of the condition led to the diagnosis of a malignant tumor of the os sacrum. In all probability it was a sarcoma belonging to the group of telangiectatic bone sarcomas characterized by a pulsation isochronic with the pulse. A test excision seemed to be contraindicated; likewise any attempts at operative removal of the tumor. Roentgen therapy seemed to be the only recourse and the patient received the following irradiation: 200 kv. (40 cm. spark gap), 3.5 ma., 0.5 mm. Zn plus 2 mm. Al, skin focal distance 30 cm., field of exposure 15 × 15 cm. Four such treatments were given at intervals of 48 hours, the surface received at each treatment a dose of 1000 roentgen units (measured with the Solomon ionometer). Distinct improvement became evident fourteen days after the last treatment. The patient received another series of four treatments as above administered about a month after the beginning of the first series.

The patient was discharged and when seen again three months after termination of the last treatment all symptoms had disappeared and the girl was as active as ever. The roentgenogram showed reappearance of the os sacrum, somewhat deformed and not quite complete. The menses had appeared once before the occurrence of the accident and have not reappeared since. It is to be feared that these will not return, since the ovaries of necessity had to be included in the zone of irradiation. However, the mammae and pubic hair appear to be developing normally which suggests that the secondary sex characters are developing as if the ovaries, despite interruption of their normal menstrual function, still retained their endocrine activity. There is no justification for calling this a cure in view of the short period of observation, and the case must be studied further.

Béclère, A. Supplementary remarks on postoperative prophylactic roentgen therapy in breast carcinoma. *Strahlentherapie*, 1926, xxi, 567–576.

Experience in a number of clinics in Germany and in Sweden with the single intensive postoperative roentgen treatment seems to indicate that the number of recidives during the first year is not diminished but in fact is increased. A study of the various experiments on the biological effects of roentgen rays seems to indicate that latent cancer cells exposed to a single intensive roentgen irradiation will suffer no more than the surrounding normal tissues. Moreover such an intensive treatment would have a tendency to damage the normal structures, perhaps sufficiently to furnish fertile ground for malignant development.

The author has pursued a technique of prophylactic postoperative irradiation in mammary carcinoma which seems to possess advantages over the single dose treatment. The radiations are more penetrating than those previously administered, but he has retained the old proven technique of medium doses given at intervals during the two years following operation. Under such conditions the epidermal tissues suffer no injury while at the same time any neoplastic cells in a state of latency accumulate the successive doses. It may be easily calculated that a surface dose of only two-thirds of an erythema dose repeated eight to ten times during the first year and four to six times during the second year after operation will accumulate without loss in the neoplastic cells a total dose about eight to ten times greater than the dose that could be administered in a single intensive irradiation.

Bergerhoff, Walther. Deep therapy in bronchial asthma. *Strahlentherapie*, 1926, xxi, 681–684.

The method of choice in the treatment of bronchial asthma seems to be the irradiation of the hilus glands with a sufficient depth dose of roentgen rays. In the few cases where this method is really ineffective, irradiation of the spleen is to be advised.

The author employs the technique of Irle. Two fields, each 15 cm. in diameter, on the chest and back are irradiated ten times at a distance of 32 cm. through 0.5 mm. Cu. The Symmetrie apparatus is operated at 5.5 amp. primary, 2.5 ma. through the tube (Metro-Müller), 32 cm. parallel spark gap with a reading of 102 to 103 on the hardness meter to give a skin erythema dose of 716 R in 48.5 minutes. Each field receives a dose of one-fourth of a skin erythema dose per exposure. Under the above conditions of operation, the percentage depth dose at a depth of 10 cm. is 32.4 per cent and at 15 cm. 14.7 per cent as measured by the Siemens measuring apparatus in the water phantom.

In view of the effectiveness of the results and the physical changes, it is hardly possible to ascribe the effects of the irradiation to mere suggestion upon the patient.

Küstner, H. The problem of the unit of dosage of roentgen rays. *Klin. Wchnschr.*, Sept. 24, 1926, v, 1837–1840.

A review is presented of the present status of the problem. An outline is given of the growth of dosimetry from the first device made by

Holzknecht in 1902 to the various quantimeters and dosimeters now in use. The French and German R units are described and discussed. The calibration of the small ionization chambers appears to be justified for their use in determining superficial doses and in determining depth doses indirectly on the phantom or directly through the rectum or vagina. For the latter purpose they will probably be always indispensable.

Studies by the author have disclosed rather considerable errors and uncertainties in the measurement of the superficial and depth doses. These appear to depend on the difficulty of measurement itself and upon the unreliability of the dosimeter. The future of dosimetry appears to be that the physician will use preferably the large ionization chamber calirbated in R units in which the errors of the smaller chambers are more easily avoided and the sensitiveness of which can be easily determined with the aid of a small quantity of radium. The author has devised an apparatus that seems to solve this problem. The dose will then be determined in R units in an exposed chamber and the hardness will be determined after filtration by the half-value thickness of copper. The application of these values to superficial and depth doses will then have to be made with the aid of tables which will have to be constructed with the aid of precise measurements made in the laboratory.

The skin erythema dose directly upon the patient will always remain a valuable control of any calibration. Likewise the Sabouraud-Noiré pastille in conjunction with the Holzknecht radiometer will always be of great aid to the therapist because they give an index of the total amount of radiation administered.

MAYER, ERNST G. Considerable increase of the roentgen effect in the irradiation of malignant and benign tumors. *Wien. klin. Wchnschr.*, Feb. 4, 1926, xxxix, 170–171.

This is a report to the Society of Physicians, Vienna, on the acceleration of the roentgen effect upon tumors by intravenous injections of glucose solution. Five cases are briefly reported. During the preceding two months about 25 cases of carcinoma have been treated in this manner. Five of the cases could not be followed up, and of the remaining 20 there was no pronounced decrease of the tumor in ⅗ of the cases, while 13 showed tumor regression and amelioration of symptoms. Among the latter were cases that had previously proven refractory to radiation therapy. Among the others the regression of the tumor was faster than anything previously noted. Prompt effects were also noted in sarcomas, but since these tumors are often of high radiation sensitiveness nothing definite can be concluded from them. The response of a roentgen-refractory sarcoma to this treatment remains to be determined.

The author sought to increase the roentgen effect by various medicaments and concluded that if it were possible to increase the biological activity of the tumor cells even for a short period the tumors might be affected more intensely by the roentgen rays. It was found that intravenous injections of 33 per cent protein free glucose in 10 c.c. quantities preceding roentgen irradiation had an extraordinary effect. The tests were carried out in hopelessly inoperable cases and real acceleration and intensification of the roentgen effect could be demonstrated. How far the clinical effect wil extend remains to be determined.

MAYER, ERNST G. Results of the treatment of carcinoma with a combination of roentgen rays and intravenous dextrose injections. *Klin. Wchnschr.*, Aug. 13, 1926, v, 1519–1520.

From certain theoretical and clinical considerations the author tried intravenous dextrose injections together with roentgen therapy in certain hopeless cases of carcinoma at the Holzknecht Institute. The first results were so striking that a more extended trial appeared justified. The patients received the customary roentgen treatment, i.e., a full dose over one field every day and in addition preceding each irradiation, there was given an intravenous injection of 10 c.c. of a 10 to 50 per cent glucose solution. Fifty cases have been treated in this manner, including cancers of different portions of the body. In 11 cases the cancer continued to develop apparently unaffected; in 9 cases the condition remained the same; in 6 there was partial improvement; in 17 there was improvement of the whole clinical picture, and in 7 there was improvement of the whole clinical picture succeeded by a turn for the worse. Only four months have elapsed since this treatment has been instituted and therefore conclusions cannot be drawn, but the fact that such highly refractory conditions as carcinoma of the tonsils have shown a favorable response is worthy of note.

The impression is obtained that the effect of the injections is an acceleration and intensification of the roentgen effect.

It is to be remembered that intravenous injections of hypertonic glucose solutions are able to awaken latent infections. Consequently the author finds it advisable to interrupt the radiation treatment in those cases showing a febrile reaction to the glucose injections until

the time when the temperature returns to normal.

Menees, Thomas O. Intragastric radium treatment of carcinoma of the stomach. *J. Am. M. Ass.*, June 19, 1926, lxxxvi, 1904–1905.

The application of radium immediately to the growth has definite advantages over external roentgen therapy alone in the treatment of gastric carcinoma. For accurate placing of the radium, both tube and tumor must be visualized. The radium tube in the stomach is readily visible under the roentgenoscope but the tumor is invisible without a contrast medium. With the usual contrast medium the tube is lost in the barium shadow. This suggests the use of air as it will contrast both. The air must be confined, to keep it under control and prevent it from rising to the highest point of the stomach.

To meet these requirements the author employs a rubber balloon cemented to a small rubber tube. The radium on a flexible wire coil is placed inside this and the bulb of a sphygmomanometer is attached to the other end of the tube. This applicator when passed into the stomach and distended gives a clear outline of the radium tube and the carcinomatous filling defect. The spiral wire carrying the radium is attached to the piston of a syringe so that any movement of the piston is transmitted to the radium tube at the other end of the spiral, and the radium can be pushed around and placed at the desired point. It is important to determine the position of the radium .n three planes without moving the patient and displacing the radium, hence an arrangement should be made for roentgenoscoping the patient in several planes without the position of the patient being changed.

The radium is lightly filtered (0.5 mm. silver) to obtain the greatest surface effect and to minimize the time of application. The treatment is divided into short sessions of one to three hours daily and continued until all of the accessible surface of the tumor has been covered. Radium cannot be satisfactorily placed in all cases by this method. Where the lumen is much narrowed or tortuous it may be impossible.

Since the majority of gastric cancers are relatively insensitive to radiations, this method is practically only palliative. It is of value in slowing the rate of growth and relieving pain and hemorrhage. Probably, the greatest value is in opening up the narrow portions of the stomach by destruction of the surface of the tumor and preventing an obstruction with its violent train of symptoms. There is also an increased fibrosis of the deeper portions of the tumor with restraint of growth and obliteration of blood vessels. Complete retrogression of the tumor is to be expected only in highly cellular anaplastic growths which are not too extensive. Since the method is practically palliative, it is no competitor of surgery but rather a complement. The pyloric growths accessible to surgery are the most difficult to apply radium to accurately. With the less surgically accessible, cardiac growths it is much easier to place radium.

Novak, Emil. The treatment of functional uterine hemorrhage. *J. Am. M. Ass.*, April 10, 1926, lxxxvi, 1105–1107.

The methods of treatment of functional ("idiopathic" or "essential") uterine hemorrhage include organotherapy, repeated curettage in recurrent cases in young women, radiotherapy, especially in patients at the menopausal age, and hysterectomy at menopause under certain conditions. A certain number of mild cases appear to correct themselves spontaneously.

It is essential that no other diagnosis should be entertained in such cases until the possibility of malignancy has been excluded and for this reason the diagnostic curettage is necessary. In no other way can the nature of the trouble be established. Especially distinctive is the finding of hyperplasia of the endometrium. Only by diagnostic curettage can one exclude the existence of adenocarcinoma of the corpus. In most cases curettage will be followed by relief from the hemorrhage and in many cases this relief will be permanent.

In women who have lived their reproductive lives and in whom the matter of further child bearing need not be considered or at any rate is distinctly subordinate to that of health, the indication is clear for radiotherapy. This is the almost ideal indication for radium in gynecology, for menstruation can be checked promptly and with certainty. In uncomplicated cases there would seem to be no reason for hysterectomy where radiotherapy is available. In cases, however, in which there is some associated lesion indicating laparotomy, hysterectomy is a perfectly justifiable and effective procedure so far as correction of the bleeding is concerned.

Samuel, E. C., Blum, H. N., and Bowie, E. R. Roentgenotherapy of exudative iritis. *J. Am. M. Ass.*, Sept. 25, 1926, lxxxvii, 1033–1034.

The first observation of the therapeutic effect of roentgen rays upon iritis was in a case due supposedly to trauma in which roentgen-ray exposure was made to determine the presence

of a foreign body. There was a large fibrinous exudate in the anterior chamber, and it was noted that rapid disappearance of this spongy material followed roentgen-ray exposure. This happened without the administration of internal treatment, only mydriatics being used to keep the ciliary body at rest and to dilate the pupil fully. Subsequent experience has demonstrated that the above effect was not exceptional. In several different laboratories the results all showed a marked amelioration of symptoms following roentgen therapy with prompt, eventually complete resolution of the lesion.

The cases of iritis that have been treated were of the exudative type, classified in different textbooks as spongy iritis or croupous iritis. The causation in the majority of cases has been syphilitic.

The technique is simple. An exposure is made over the affected eye or eyes for 30 sec. with rays produced by 5 ma., 5 inch gap filtered through 1 mm. Al, distance 20 inches. There is probably no virtue in the prolongation of the time of exposure by the reduction in the milliamperage, except that it seems to make more of an impression on the patient. The amount of irradiation may seem to some ridiculously small since it cannot be considered to total more than one-twentieth of an erythema dose through a millimeter of aluminum.

Scott, Arthur C., Jr. Cauterization and cautery excision of cancer. *J. Am. M. Ass.*, Oct. 9, 1926, lxxxvii, 1188–1193.

The theory of cauterization is sound except that its practice results in mass destruction of tissues, and the quantity of radiated heat applied at every point where it may be needed is an uncertain element. Although this heat is measurable, in actual practice it is not measured in every case. The method of choice in cauterization at the present time is to use the cautery at a white heat whenever the situation of the tumor will permit. This cannot always be done, however, in certain situations around the eye and in other regions. Cosmetic considerations are coming to be considered less and less where malignant growths are involved.

Freedom from local recurrence for a period of three years should be the criterion of the effectiveness of a particular method of local treatment for surface and readily accessible subsurface malignant growths. On this basis, the cautery excision operation and the cautery gland dissection are found more efficacious than the direct cautery operation. Either of the cautery methods is superior to the knife operation or other local methods of treatment of superficial cancers. The curability of surface and readily accessible subsurface malignant growths has been substantially increased by the cautery excision and cautery gland dissection operations.

Of 1000 cases studied since 1906, nineteen of the cases had to be discarded because of insufficient data. The 981 remaining cases are divided into three main classes: cauterization operation cases, 308; cautery excision operations 482, and cautery gland dissection with excision, 191. The operative mortality in the entire series was 0.4 per cent. There were 469 cases living five years or longer after operation; and 617 three years or longer after operation.

In the group of traced cauterization cases in which operation was done three years or longer previously there were 6.6 per cent with local recurrences. In the cautery excision operations there were 3.5 per cent cases with local recurrences present three years or longer after operation. In the cautery gland dissection group there were 3.7 per cent with local recurrences.

Section of Surgery, Royal Academy of Medicine in Ireland. Discussion on the roentgen-ray treatment of exophthalmic goiter. *Lancet*, April 17, 1926, i, 812–814.

Maurice Yayes points out that statistics on the surgical treatment of exophthalmic goiter are copious and reliable, while those of treatment by radiation are as yet incomplete; but a comparison of the results indicates that roentgen treatment would probably furnish about the same percentage of permanent cures as surgical treatment in the best hands. Roentgen treatment has the disadvantage that it is prolonged and that there is the risk of atrophic changes and telangiectasis in the irradiated skin. There is ample clinical evidence from the amelioration which has followed roentgen therapy to justify its employment on rational grounds as a most useful adjunct in the treatment of Graves' disease. Of 100 cases of Graves' disease treated by Hayes during the past fifteen years, 60 were cured and able to follow their usual occupations, and 14 were improved.

T. G. Hardman collected about 60 cases and found over 75 per cent of the patients cured of their symptoms by roentgen treatment and 22 per cent greatly improved. The success of radiotherapy depends very largely on the strictness of the medical regime. The cases which did best were those which were treated in private where they could have the absolute rest and regulated life which are so essential.

H. Stokes does not think statistics of much value in discussing the treatment of exophthalmic goiter, because it has only recently been recognized that there are two varieties of the

disease, toxic adenoma and Graves' disease. The mortality in toxic adenoma is just as high as ever, but with the use of iodine in Graves' disease the mortality has come down to 2 per cent. There are undoubtedly cases of well-marked exophthalmic goiter which got well in a remarkably short time but they were apparently a mixture of toxic adenoma and Graves' disease.

T. G. Moorhead finds from the scanty figures available that the medical death rate from exophthalmic goiter is not very high. There is a general opinion that about 50 per cent of recoveries from exophthalmic goiter may be expected, so that any treatment that does not improve on this figure might be regarded as of no value. In considering surgical treatment the immediate mortality in some clinics is very low, although in others it may be from 9.3 per cent up to 31 per cent. The ultimate results following operation are very difficult to arrive at, and there are indications that they are not so good as has been claimed by many. The results of roentgen treatment of exophthalmic goiter seem to be very encouraging. In a series of 51 private cases there were 34 complete cures and 7 very much improved as the result of roentgen treatment. The combination of medical and roentgen treatment seems to give the best possible results without involving any hazard to the patient. Acute cases seem to do much better than milder and more chronic cases; and private patients, on the whole, did better than those in the hospital. Details of treatment are extremely important. A double course of roentgen-ray applications was given to the patients. Each of these treatments was of about three weeks' duration with a pause of a month intervening. The thymic region should be irradiated as well as the thyroid. Lugol's solution has been successfully used as an addendum to the treatment.

H. F. Moore treated his cases by general treatment, iodine and roentgen rays under control of basal metabolic rate and clinical observations; but he did not hesitate to have recourse to surgical treatment where he thought it necessary.

William de C. Wheeler indicates that the results of surgical operation can be more accurately estimated, but the ultimate mortality from failure of medical treatment is difficult to ascertain. In nearly all of the cases operated on by him, medical treatment and radiotherapy had been tried first, but it is quite possible that a number of the patients had not submitted faithfully to the directions of the physicians. The statistics given in the literature are often faulty owing to the comparison of inefficient surgery and efficient medicine or of efficient surgery and inefficient medicine. If a comparison is made of the best results by surgical, medical and radiological techniques it would be found that the honors are easy. In most cases a combination of methods is desirable. Lugol's solution is an immense help in preparing patients for operation, and it will control postoperative remissions. About 5 per cent of patients did not react to the administration of iodine.

R. Stumpf states that if cases considered most favorable for operation receive a preliminary roentgen treatment about a fortnight beforehand the operative risk is lessened. In a series of cases of which the majority were treated by roentgen rays alone, 90 per cent showed either cure or great improvement. Where there was no improvement after several irradiations operation was done. Ill effects were more likely to occur after the use of superficial rays than after deep therapy. Cases are known in which adhesions were found at operation although the patients had never been irradiated. He always irradiates the thymic region even when no enlargement is present; and in cases of simple goiter he always prefers roentgen treatment to operation even in juvenile cases.

Wise, Fred. Progress in the treatment of skin diseases. *J. Am. M. Ass.*, May 8, 1926, lxxxvi, 1409–1411.

There was a time not so long ago when mycosis fungoides was regarded as an utterly hopeless condition so far as treatment was concerned. With the advent of roentgen therapy this has all been changed and the patient with this disease has a reasonable prospect of the condition being controlled. Fordyce has told of two patients who were treated with roentgen rays combined with intravenous arsphenamine injections and who had remained apparently cured during a period of three years. Two additional examples of the alleviative power of roentgen rays are briefly mentioned.

Closely related to mycosis fungoides from the standpoint of therapy are the sarcoma of Kaposi, the leucemias, lymphogranulomas and kindred diseases. In early cases of sarcoma of Kaposi in which the lesions are relatively small and not numerous, cures have been reported with roentgen therapy, sometimes combined with arsenical medication. In extensive and especially in the long neglected cases, roentgen therapy administered in massive doses of filtered radiation will bring about absorption of infiltrations and tumors, relieve pain and prolong life.

Juvenile ringworm may now be treated by the Kienböck-Adamson technique so that only about seventeen to twenty-one days are

required, while the old method of manual epilation and constant application of antiseptics required anywhere from six months to three years.

Angiomas will respond to radium therapy with an outcome that seems magical in the excellence of its surgical and cosmetic results. Many types of angioma of the skin and mucosa which the surgeon formerly did not consider a good surgical risk are today readily curable with radium.

ZIMMERN and COTTENOT. Roentgen therapy of neuralgias. *J. de radiol. et d'électrol., Par.*, July, 1926, x, 306–312.

The authors find that roentgen therapy applied to the root of the affected nerve is very effective, while if it is applied to the peripheral course of the nerve it does no good at all. The rays in radicular roentgen therapy may act on the inflammatory lesions, such as arthritis or periostitis which cause the neuralgia or they may free the nerve from infiltrations which are compressing it. The first hypothesis seems to be the true one, judging from the results they have had in the treatment of some cases of non-tuberculous arthritis of the wrist, knee and tibiotarsal joint, the second from the rapid absorption of skin infiltration in some cases of lupus and sycosis. Radicular roentgen therapy has also been found useful in the treatment of certain forms of pruritus and some authors have used it successfully in lichen planus.

It is not necessary to use very hard rays. The authors use 20–25 cm. spark gap and filter through 5 mm. aluminum. They have tried large doses but found them less effective than small doses frequently repeated. Their average dose is 2 H (200 R) at each treatment, repeated every other day until a series of 4 or 5 treatments have been given; then after an interval of ten days another series of 4 or 5 irradiations may be given if necessary. The bundle of rays is directed obliquely inward and forward and centered on the line of the spinous processes. A localizer is not necessary as free irradiation of the whole root region is preferable. For facial neuralgia the rays should be centered on the middle of the zygomatic process and a localizer about 6 cm. in diameter may be used.

They have treated 67 cases of sciatica with 38 recoveries, 18 improvements and 11 failures; and 41 cases of neuralgia of the brachial plexus with 28 recoveries, 7 improvements and 9 failures.

MISCELLANEOUS

BORAK, J., and DRIAK, F. Studies on roentgen irradiated melanosarcomas. *Strahlentherapie*, 1926, xxi, 550–560.

The radiation sensitiveness of tumors does not need to be exclusively associated with the proliferative activity of the cells. It would seem rather that the particular cell function which is most active is the one that is first influenced by roentgen rays and by comparatively small doses. Since in most malignant tumors and also in certain normal organs (for instance, in lymphatic tissues, etc.) the proliferative activity happens to be the most active, it follows that this cell activity is also the most sensitive to irradiations. In many other normal organs and in certain malignant tumors, however, other functions may be biologically more active and these are the ones that succumb first to the radiations. This relationship between biological activity and radiation sensitiveness demonstrates that the radiation sensitiveness is not an accidental attribute of a cell type but should be recognized as the manifestation of an essential cell property. From this relationship it follows that although roentgen rays act primarily only in a biologically depressive sense, they do not, however, always exert a destructive action on the life of the cell but often merely depress a single cell activity.

These conclusions are drawn from observations in a case of melanosarcoma which received a dose of 15 H through 2 mm. Al over several non-pigmented nodules which regressed completely while not a single one of the pigmented nodules in this case seemed affected. Nevertheless the irradiation of the pigmented foci caused urinary secretion of melaninogen which began two days after treatment and lasted for three days. It was noted that this melaninogen excretion never appeared spontaneously before the treatment nor after irradiation of non-pigmented areas. After treatment the pigmented zones appeared lighter in color and some of them underwent decrease in size after a dose of 20 H through 4 mm. Al, but this decrease took place after several weeks, long after the melanin excretion began.

BREITLÄNDER, K., and FELKE, H. Hair hypertrophy after roentgen irradiation. *Klin. Wchnschr.*, July 30, 1926, v. 1429–1430.

A report is given of a case occurring in a farmer boy aged fifteen who received roentgen treatment for a nasopharyngeal fibroma. The first treatment was through four fields, with a calculated dose at the tumor of 80 per cent of the skin erythema dose. The operating factors were 182 kv. effective, 4 ma., 0.5 mm. Zn plus 1.0 mm. Al, focal skin distance 30 cm.; 3 fields were over the neck, median, left and right, and one median field over the face. The skin

received 90 per cent of the skin erythema dose (450 R). Five weeks after the treatment the fields in the neck were entirely epilated; and in the tenth week they were still epilated with boundaries sharply corresponding to the areas exposed. At this time a very fine downy growth appeared here and there in these areas.

Microscopic examination was made of the downy hair and of the normal hair of the unirradiated portion of the scalp. The latter was a blond papillary hair having adherent to its lower end the external root sheath. The medulla was only slightly developed and showed extensive breaks; and by reflected light it disclosed only few air bubbles. The hair from the irradiated area, on the other hand, was almost twice as thick, showed a strongly pigmented cortex and a much more highly developed medulla containing numerous air bubbles. There were also present the same breaks in the medulla.

About two-thirds of the hairs in the irradiated areas showed the above peculiar characteristic. This apparently pathologic change is unusual.

Burrows, Montrose T., Jorstad, Louis H., and Ernst, Edwin C. Cancer, vitamin imbalance, and roentgen-ray activity. *J. Am. M. Ass.*, July 10, 1926, lxxxvii, 86–90.

Cancer is only the result of anything that leads to an excessive production of vitamin B or that removes the vitamin A or growth inhibitor from small areas of tissue in the body. Roentgen rays act only to increase the vitamin B content in the tissues. With proper dosage, therefore, it may produce cancer, as it may through the excessive production of vitamin B destroy cancer. Cancer is only the result of a vitamin imbalance. Normal life depends on a proper balance between vitamins A and B. The problem of the cure of cancer is the restoration of this balance. The problem of the prevention of cancer is the prevention of such imbalances taking place.

Roentgen rays act on the organism to produce vitamin B. Larger doses of these rays lead to the liberation of larger amounts of vitamin B with a secondary production of vitamin A. These larger doses of roentgen rays lead always to an early exhaustion of the rat, while such doses repeated over long intervals do not cause this early exhaustion.

The roentgen ray becomes important in the cure of cancer in that it liberates an excess of the archusia or vitamin B from the cells when given in the proper doses. As must be noted, the cancerous tissue contains already a high content of the archusia. Only a slight stimulation is sufficient to increase this amount to a value which causes the cells to degenerate. The normal tissue contains much less archusia. The same dose acting on them may not even cause them to grow.

The first problem, as is evident, for the advance of roentgen therapy is a proper and well controlled dosage. The second problem is to produce the proper reaction in the surrounding normal tissues. Too great a dose on these tissues must cause a decrease in blood supply and make them more favorable for the spread of the cancer. The prevention of this spread of the cancer lies in the protection of the blood vascular system in these regions. Experiments show that the vascular system is only the path of inflow of the vitamins from without. The progress in roentgen therapy will come first through the establishment of a uniform method of dosage, and the establishment of appropriate dietary and nutritional conditions in the patient before such therapy is instituted.

Cramer, H. Biological effects of irradiation (preliminary communication). *Strahlentherapie*, 1926, xxi, 633–643.

The effects of roentgen and radium rays on the living organism may be enumerated as follows: (1) a photochemical reaction; (2) a local tissue reaction; (3) an immediate reaction; (4) a temporary increase in function; (5) dependence of the reaction on an intact circulation; (6) the reaction is nonspecific, and (7) it appears to be due to a catalytic oxidation involving the participation of iron; (8) the reaction is inhibited in the frog during the winter hibernation, which can probably be explained by oxygen deficiency.

The author's experiments from which the above conclusions are drawn were made upon the mesentery of the frog.

In essence, the process appears to be a physical stimulation of a catalyzer of chemical processes associated with morphological changes that are visible. Whether the processes are real oxidations does not really matter as regards the important conclusion that the roentgen rays produce their effects upon oxidation reduction processes by influencing a catalytic reaction.

Davis, John Staige. The treatment of deep roentgen-ray burns by excision and tissue shifting. *J. Am. M. Ass.*, May 8, 1926, lxxxvi, 1432–1435.

When a deep roentgen-ray burn occurs and the ordinary local methods have been tried for a reasonable time, nothing is gained by delaying operative work. In fact delay in radical treatment may be dangerous as malignant degeneration is not uncommon in certain

types of these burns. In none of the cases referred to the author has treatment with ultraviolet and other radiations been beneficial. Early excision of deep burns with tissue shifting promises more surely than any other method yet devised a reasonable prospect of permanent relief in a comparatively short time. Pain is eliminated and in many instances function is restored, and patients who have been incapacitated for years have been returned to their former activities. The ultimate results have been gratifying.

Excision with tissue shifting is also the procedure of choice in chronic deep radium burns and ultraviolet burns, and promises a quicker and better result than any other method.

In the ideal case the ulcer and the surrounding area of induration should be excised out to and down to healthy tissue. In many instances, however, complete excision is impossible on account of the extent and situation of the burn, but in these cases the excision should be as radical as the circumstances will permit.

When the exposed tissues seem normal and the excision has been complete grafting may occasionally be performed immediately. In the majority of instances following the excision of deep old burns there is a general oozing which it is almost impossible to check. In these cases one must wait until granulations begin before grafting is performed. The type of graft used depends on the location of the lesion.

GRAHAM, ALLEN. Exophthalmic goiter and toxic adenoma. *J Am. M. Ass.*, Aug. 28, 1926, lxxxvii, 628–631.

It is commonly held that exophthalmic goiter and toxic adenoma are two separate disease entities. There is, however, not a single symptom or sign that can be recognized as necessarily pathognomonic for exophthalmic goiter as opposed to toxic adenoma. There is not a single anatomic or histologic alteration in the thyroid in either the adenomatous or the non-adenomatous portion of the gland that is necessarily pathognomonic for exophthalmic goiter as opposed to toxic adenoma.

There are equally good reasons for speaking of dysthyroidism in both these diseases. The degree of hypertrophy and hyperplasia of the thyroid determines the quantity of iodine that will be tolerated without untoward effects in both exophthalmic goiter and toxic adenoma. In both of these the reaction to iodine is fundamentally the same.

There therefore remains no alternative but to regard exophthalmic goiter and toxic adenoma as clinical variations of a single morbid state.

HANCE, ROBERT T., and MURPHY, JAMES B. Studies on *x*-ray effects. XV. The prevention of pigment formation in the hair follicles of colored mice with high voltage *x*-ray. *J. Exper. M.*, Sept. 1, 1926, xliv, 339–342.

In the course of a study of roentgen-ray dosage it was noted incidentally that the hair of rabbits became white within an area exposed to high voltage radiations. Since color and not the production of hair was affected it was considered desirable to gather more complete data in the hope it might eventually throw some light on the biological action of the different wave lengths.

Experiments were made upon black haired mice receiving rays from a tube operated at 70 kv., 8 ma., the exposures ranging from 20 to 100 min. at 36 mm. target distance.

The most complete color change was obtained in animals which had been exposed from 50 to 100 min. The growth of hair was a little slow in getting started but after the lapse of a month it was as long and thick as that in unexposed portions of the body. The hair in the areas exposed from 70 to 100 min. grew more rapidly than that in the spots receiving 50 to 60 minute doses.

Comparatively little seems to be known about the pigment production in hair. Whatever the actual processes responsible for the presence of pigment, it is evident that in some way hard roentgen rays interfere permanently with the hair pigmentation. In addition to destroying the color developing power of the hair, the structure of the cortical cells must be altered in order to permit the entrance of air between them. The effect of the roentgen rays is due to direct action on the exposed areas because the change does not spread into the shielded zones. None of the hairs in the exposed areas were banded; the hairs were either all black or all white, the latter gradually replacing the former. Exposure of the ventral side of the mouse to roentgen rays causes the hair on the back to whiten about forty to fifty days after it has whitened the hairs on the abdomen.

HELMHOLZ, HENRY F. Exophthalmic goiter in childhood. *J. Am. M. Ass.*, July 17, 1926, lxxxvii, 157–162.

At the Mayo Clinic 30 cases of exophthalmic goiter were observed in children less than fifteen years old, mostly from the goiter belt of the United States, during the period from January, 1921, to March, 1926. Compound solution of iodine administered in doses of 5 to 10 minims (0.3 to 0.6 c.c.) three times a day reduced the basal metabolic rates and toxic

symptoms very markedly. It made preliminary operations unnecessary in the last 11 cases. Of the 23 patients operated on, 2 died, one in crisis twenty-four hours after operation, and the other from bronchopneumonia one week after operation. Four typical cases are briefly cited.

Hottinger, A. Irradiated cholesterin in the therapy of rickets. *Klin. Wchnschr.*, Oct. 29, 1926, v, 2061–2065.

Experimental rickets in rats can be cured by the administration of ultraviolet irradiated cholesterol or cholesterol ester just as well as by the direct irradiation of the animal. This acquired antirachitic property is not inactivated by baking the cholesterol incorporated in bread.

Irradiated chaulmoogric acid allyl-ester is inactive; and cholesterol loses its activity if irradiated for much over four hours at a distance of 60 cm. All cholesterol preparations, the melting point of which had dropped below 143° as a result of irradiation, failed to exhibit biological activity.

Rickets in children is cured by irradiated milk (perhaps owing to the cholesterol present) even when the children are maintained under rachitogenic conditions. The irradiated milk appears to be more effective than cod liver oil or unsaponifiable fractions of the cod liver oil and is almost as effective as the direct irradiation of the exposed body of the child. Irradiated cholesterol under the same rachitogenic conditions has a favorable effect upon the child only when administered in large doses (2 to 2.5 gm. daily). The irradiated cholesterol if kept in an aqueous suspension during treatment exhibits no activity.

The above conclusions are based on numerous animal experiments and the details of the treatment in 5 children are tabulated. Roentgenograms are shown in the case of one child in which the typical signs of florid rickets remained unchanged after a three weeks' treatment with cholesterol which was irradiated in a watery suspension. This same case when treated for two and a half weeks further with irradiated cholesterol not in contact with water showed complete healing clinically, biochemically and roentgenologically.

Jerman, E. C. One hundred milliampere, one-tenth of a second technic. *Radiology*, June, 1926, vi, 513–515.

Details are given of the 100 ma., $\frac{1}{10}$ of a second roentgenographic technique as applied to the infant, and to the chest, heart and extremities in the adult. For roentgenography of the chest the distance recommended is 40 inches with tube operated at 78 kv. peak; for the heart the distance should be 6 feet with the tube at 95 kv. peak; for the extremities the distance should be 36 inches with the tube at 75 kv. peak. The principal difficulty in roentgenographing infants is the danger of movement of the patient; the distance recommended is 36 inches with the peak voltage varying from 65 to 80 kv. depending on the thickness and density of the region exposed. The above details are for the 5–100 radiator tube.

The equipment necessary for this technique requires a transformer of sufficient capacity with a good regulation. A stabilizer is practically a necessity in order to obviate the need of tube testing and to keep the milliampere factor constant regardless of the peak voltage used. A time switch of tested accuracy should also be available. Double intensifying screens should be used.

Jona, M. Pulsating or constant high tension direct current in roentgen therapy operation? *Strahlentherapie*, 1926, xxi, 690–695.

Practical measurements and theoretical considerations lead to the conclusion that a roentgen tube operated with constant high tension current will yield approximately 40 per cent greater output of rays than the same tube operated with pulsating high tension from a high tension rectifier,—assuming that the mean current through the roentgen tubes in both cases is the same. A mere consideration of the facts makes the above increased output quite plausible.

There are a variety of conditions in which the primary voltage is not necessarily an index of the secondary, thus rendering the readings on the so-called prereading kilovoltmeter questionable except under standardized conditions. The voltage readings to be reliable must be checked spectrographically, and this is especially necessary where a transformer apparatus is modified by the addition of condensers for the production of constant direct current.

The author demonstrates by means of measurements on a Radio-Transverter apparatus that the employment of correct principles of construction and reliable calibration verify the general applicability of the theory predicting the increase in output of a roentgen-ray tube by going over from pulsating high tension to constant high tension current.

Kennedy, William H. Radium applicator for treatment of lesions about the head, face and neck. *J. Am. M. Ass.*, June 19, 1926, lxxxvi, 1907.

The applicator described consists of a leather

head band, copper wire and universal ball joint made to be used with $\frac{1}{4}$ inch rubber tubing in which the radium is placed. The heavy copper wire can be bent to proper adjustment, which remains unchanged, while at the same time allowing the patient to move his head with freedom.

KEYES, EDWARD L. The treatment of bladder tumors with metal seeds containing radium emanation. *J. Med. Soc. N. Jersey*, October, 1926, xxiii, 485–488.

Carcinoma of the bladder can be controlled and cured provided the surgeon treating it revises his old point of view. The surgical attack upon bladder carcinoma has in the past depended upon a wide resection of the bladder which left the patient with an even chance of dying later of this disease. Heretofore the choice of treatment lay between resection with its operative mortality of 10 to 20 per cent, diathermy with its slow healing and danger of perforation, and finally glass radium seeds producing grave slough, tedious convalescence and sometimes permanent ulceration.

The new metal emanation seeds of gold or platinum have changed the outlook completely. The encasement of the emanation in metal shuts off the destructive beta rays, while transmitting 10 per cent of the gamma rays. Clinically this amounts to minimizing slough and secondary infection and eliminating the intractable radium burn. The elimination of slough permits the operator to increase the strength of the capsule from the customary 0.2 to 0.3 mc. up to 2.0 to 3.0 mc., although the physicists seem to regard 1.5 mc. as the ideal strength. Thus the intensity of tumor destruction is actually increased to such an extent that the large intravesical capsules of filtered radium emanation which were formerly employed may now be entirely discarded.

Furthermore the implantation when done suprapubically may be made almost or quite entirely in the depths of the base of the tumor or in the bladder wall about its base. This excites no bleeding and if the projecting portions of the tumor are removed after ligature of the base, a clean wound is left. The suprapubic incision in the bladder may be sutured without drainage and the patient may be dismissed from the hospital in two or three weeks. The operator will do well to cystoscope the patient every month or so after operation, although until at least three months have past he may not be able to distinguish with certainty between tumor and effects of radium. The author has never implanted more than ten seeds, each containing 1.5 to 2.5 mc. of emanation and would hesitate to advocate the use of more than twice this number. Recurrences if amenable to treatment at all are controllable by cystoscopic fulguration or by application of radium. When the seeds are to be implanted through the cystoscope the application is made in a much more homeopathic fashion. One or two seeds per tumor suffice only because the stay of cystoscopically applied seeds in the tissue is so uncertain. Cystoscopic irradiation should be repeated at intervals of from two to six weeks. Post-cystoscopic roentgenograms will show the spacing of seeds to be very inaccurate and that some of them have fallen out. This roentgenographic control is therefore peculiarly useful in relation to cystoscopic radium therapy.

The author's experience leads him to prefer the suprapubic method of radium treatment as opposed to the cystoscopic because in the former case the application is so much more certain and the results have been more satisfactory. Five cases are briefly cited.

KINGREEN, OTTO. The roentgen irradiation of of acute inflammations. *Deutsche Ztschr., f. Chir.*, 1926, cxcvii, 10–17.

The experience of the author indicates that the effects of roentgen rays upon acute inflammations are very similar to those produced by the injection of foreign protein. The local hyperemia appearing after irradiation probably has a favorable effect upon the curative process. Over 10 cases of different kinds of surgical infections have been treated by roentgen rays in the author's clinic. These were cases in which there was doubt as to whether an immediate incision was necessary. Thus, if an abscess appeared to be ready to break, it was not considered necessary to irradiate but to wait until the abscess opened. But where a suppuration had not yet become circumscribed or where softening had not yet taken place or in the early stages of furuncle or parulis, roentgen rays were administered. The decision as to whether one should operate or not in these cases must rest with the surgeon and not with the roentgenologist.

The roentgen rays were delivered from a Coolidge tube operated at 120 kv., at a distance of 25 cm., the rays being filtered through 3 mm. Al or through 0.5 mm. Zn plus 1 mm. Al depending upon the depth of the inflammatory focus. In some cases with large inflammatory zones, the irradiations were administered at a distance of 50 cm. but these have been unsatisfactory and have not been repeated. The best reaction is obtained from shorter distances. The dose administered was from 5 to 20 per cent, the skin never receiving more than 25 per cent. The size of the fields corresponded to the size of the inflammation

and the whole dose was administered in one exposure. The effect of the treatment varied amongst the different cases and depended naturally on the degree of inflammation as well as upon the dose administered. The more acute the inflammation, the smaller the dose necessary to secure a reaction. The response was both subjective and objective. The general reaction was insignificant as compared with that obtained from protein injections. There was a certain amount of headache and slight indisposition, but there was never any chill or vomiting. On the other hand, the local reaction was much more pronounced. The acute pain often disappeared after an initial temporary increase. Swelling and pain retreated in eight to twelve hours after irradiation.

Decidedly good results were obtained in cases of furunculosis and sweat gland abscesses. Carbuncles respond only partly to the treatment. In such cases, it is best to use roentgen rays to contract the infected focus and then excise it in order to accelerate recovery. The early stages of parulis appear to be easily controlled by roentgen treatment but in cases of acute phlegmons in the mouth, radiation therapy should be applied with great caution, especially if there is evidence of an early edema of the glottis. Astonishing response has been observed to the roentgen rays in cases of parotitis. The inflammation receded in one to two days after roentgenization without appearance of purulent breakdown. In cases of panaritis, roentgen rays should be used to stop the progress of the infection following which the focus should be excised. Erysipeloids respond very well to the treatment.

Very little has been accomplished even in the early stages of mastitis. If pus is present the inflammatory disease process may be localized, but in acute phlegmons there is little hope of producing a favorable effect with roentgen rays. There is usually no complication in the operation of mastitis in a case previously irradiated. In gonorrheal arthritis the results obtained are astonishing. The pain disappears within the first forty-eight hours and the swelling of the capsule goes down. The roentgen dose in gonorrheal arthritis may be safely increased to 40 to 50 per cent at the disease focus; the reaction is more pronounced of course but the recovery process is a favorable one. Acute lymphadenitis is also satisfactorily controlled by roentgen therapy.

In about 50 per cent of the cases there was no need to operate after the roentgen treatment. The cardinal virtue of roentgen therapy consists in its acceleration of the breakdown and the simultaneous retardation of the inflammatory process. It must be stated that the well-known conservative methods of treatment often produce the same results. Acute progressive phlegmons, especially in the neck, appear to resist roentgen therapy, and such cases should be operated on as soon as possible without losing any time in attempting a roentgen treatment.

Kolta, Erwin, and Förster, Julius. The effect of roentgen rays upon the blood. *Strablentherapie*, 1926, xxi, 644–667.

A study was made of the number of red and white blood cells, the hemoglobin content, the qualitative blood picture, the coagulation time, the hydrogen ion concentration of the blood, its bicarbonate content; and in certain cases there was also determined the alveolar CO_2 tension and the sodium chloride content of the blood. The irradiations were always performed upon fasting individuals. Ten consecutive cases were examined: one of duodenal ulcer, one gastric carcinoma, one carcinoma of the rectum, one tuberculosis of the cecum, one tabes dorsalis, one polycythemia, 3 granulomatosis and one lymphatic leucemia. The detailed data for these are given in tables. The quantity of the radiation administered varied, of course, with the individual case.

The results obtained do not agree entirely with those reported in the literature. No very uniform changes could be noticed as a result of the irradiations. A certain amount of uniformity was shown only by the decrease in the number of the white cells, the decrease in the clotting time, the increase in blood sugar, the shift in hydrogen ion concentration of the blood to the alkaline side and the decrease in sodium chloride. The latter three effects were found to be typical more or less. There seems to be a certain connection between clotting time, blood sugar and hydrion concentration of the blood; but when the individual values are considered there does not appear to be any consistent parallelism between them.

It follows therefore that the effects produced by roentgen rays upon the blood are not simple. They depend only partly upon primary effects, as for example the greater sensitiveness of the white cells and the blood-forming organs in general. The biological effect of the rays is not exactly understood and the variability of results obtained to date lies perhaps not only in the great variety of cells but also in the variability of sensitiveness and reactivity of the various individuals suffering from different diseases.

Lewis, Raymond W. The treatment of rodent ulcers by radiation. *Ann. Surg.*, August, 1926, lxxxiv, 233–236.

Radiation treatment of basal cell epitheliomas is an excellent method because of its avoidance of operation, its simplicity, excellent cosmetic results and high percentage of permanent cures. Statistically, there is little difference in the ultimate results between the treatment by radium and that by surgical excision.

Radiation treatment is inadvisable in the case of lesions involving bone or cartilage, or where the size of the lesion is 4 cm. in diameter or greater. In these conditions radium treatment should be undertaken only when a surgeon skilled in the treatment of cancer finds the patient for any reason unsuitable for operation.

The patient's risk, in treating, through mistaken diagnosis, a squamous epithelioma is probably little if at all increased if the rule be observed to refer promptly for surgical removal any lesion which increases in size after irradiation or any lesion which does not respond immediately and strikingly to one or two doses of radiation. A preliminary survey of the results of treatment at the New York Skin and Cancer Hospital shows that during the past twenty-two months radium treatment has been carried to completion in 50 cases with clinically diagnosed basal cell epitheliomas. Among these there were 5 primary failures. It has been possible to follow 29 of the clinically cured patients for periods varying from three to nineteen months after their last radium application. There have been three recurrences in this group, about 10 per cent.

Liechti, Adolf. Changes in the reaction in roentgen irradiated tissue. *Klin. Wchnschr.*, Oct. 8, 1926, v, 1911–1913.

If an acidification of the blood occurs after roentgen irradiation, this may be due either through retardation of the outflow of acid substances in the secretory organs (especially the kidney) or through the increased inflow of acids into the blood. The urine examinations of Essinger and György seem to oppose the first assumption. On the other hand, there are other reasons which favor the second view as being more plausible.

The author sought to determine the changes in acidity in the subcutaneous tissue juice by means of intravital methods with the subcutaneous electrode. Experiments were made upon rabbits and upon the author himself. The roentgen rays were produced by a Neo-Symmetrie apparatus with an SHS Müller or a Coolidge tube, focal skin distance 23 cm., 60 × 80 mm. field, parallel spark gap, 45 cm., 1.5 to 2.5 ma., filtration in the animal experiments through 1 mm. Al; filtration in the human experiment 3 mm. Al plus 0.5 mm. Zn, the dose administered in the human experiment was one skin erythema dose; in the rabbit experiments the doses ranged from 1.5 to 4.5 skin erythema doses.

The normal acidity of the subcutaneous tissue juice varied between 7.07 and 7.17 in pH units. In the human skin it was pH 7.12. Roentgen irradiation of the skin caused an acidification of the tissue fluid which occurred two to three hours after irradiation and returned to normal in several days. The degree of acidification varied from 0.1 to 0.37 pH. The acidification of the subcutaneous tissue juice appears to be a secondary humoral effect of the roentgen rays. This may be due to a variety of secondary effects at the site of absorption of the rays irrespective of whether there is involved a change in protein, of ion adsorption or of membrane permeability.

Loewenstamm, Arthur, and Stehr, Ludwig. On the problem of deep roentgen therapy in bone and joint tuberculosis. *Deutsche Ztschr. f. Chir.*, 1926, cxcvi, 340–346.

It may be stated that deep roentgen irradiation together with conservative therapy has been satisfactory in a large number of cases of bone and joint tuberculosis, although one must admit that it is very difficult to distinguish between the specific results of roentgenization and those due to general therapy. The degree of success depends naturally on the pathological-anatomical diagnosis in the particular case. There was no evidence of injury due to the small doses administered, nor was there any definite sign of a dissemination of the tuberculosis as a result of the treatment.

It has been found in accordance with general experience that the foci in smaller bones react much better than those in the larger ones. The experience of the authors is based upon 27 cases in males and 23 in females of all ages. The combined medical and roentgen treatment resulted in cure or distinct improvement in 62 per cent of all the cases. The rays were delivered from a Coolidge tube filtered through 1 mm. Al plus 0.5 mm. Cu, or 3 mm. Al plus 0.5 mm. Cu. A Fürstenau intensimeter was used for measuring the dosage. The skin focal distance was about 23 cm. The smaller joints were irradiated through two fields and the larger ones through several fields. Originally the dose was over 50 per cent of the skin erythema dose but later it was reduced to an average of 25 to 30 per cent of the skin erythema dose. Smaller doses are indicated especially in fistulous cases having very sclerosed, cicatrized skin.

Nürnberger, L. The problem of roentgen injury of the embryo. *Strahlentherapie*, 1926, xxi, 577–599.

Comparatively mild irradiations of female white mice cause severe injuries to the ripening ova. The latter do not lose their fertilizability but the resulting embryos degenerate very quickly in the very earliest stages before their implantation. Theoretically, however, it is not at all impossible that a sufficiently small dose of roentgen rays may be administered which will permit birth of full term but deformed embryos. However, all experiments thus far tried lead either to the birth of apparently normal young or to incomplete gestation.

A total of 104 observations have been made on the offspring of the F_2 and 14 of the F_3 generations of irradiated animals and in none of them were there observed any anomalies that could be attributed to effects of the roentgen exposure. This observation is in apparent contradiction to the findings of Bagg and Little. However it is suggested that in the experiments of the latter authors both male and female members of a mating were irradiated, while in the author's experiments only the female was exposed, the object being in the latter case to determine the effects of irradiation upon the ovum.

A theoretical consideration of genetic principles would indicate that if roentgen rays do exert an injurious effect on offspring that such an effect would dispel itself as an inconstant polymer-recessive hereditary factor. This conclusion is based entirely upon speculative considerations, and there is at present no proof of the actual existence of the condition.

Penzoldt, Richard. Temporary sterilization and injury to the embryo. *Strahlentherapie*, 1926, xxi, 625–632.

At the Wintz clinic the following attitude on the subject is taken: If a woman has been subjected to a temporary roentgen sterilization and as a result has had an amenorrhea for at least four months, and if subsequently pregnancy occurs no fear need be entertained that the child will show injury due to roentgenization of the mother. The following facts suptemporary sterilization dose there is nothing to prevent its discharge. The bursting of the Graafian follicle is a purely mechanical process in no way influenced by the roentgenization. This ovum could become fertilized and yield a deficient embryo. There is, however, port this view. A single irradiation with an exact dose of 28 per cent, designated the temporary sterilization dose, produces only a recoverable injury in the ovary. The follicular cells of the Graafian follicles are more roentgen sensitive than the cells of the primordial follicle. When a ripe Graafian follicle receives a at present no known case in which this has been definitely demonstrated. It is, however, believed that the fertilizability of such an ovum is not very probable. It is assumed that should conception take place within four months of roentgenization, injury to the ovum is considered possible to such an extent that interruption of the pregnancy should be seriously considered. If fertilization takes place at a later time no deficiency in the offspring need be anticipated. By observing the above rule under strictest indications the temporary roentgen sterilization of the female becomes a justifiable procedure.

An analysis of all the factors bearing on the subject explains why there is no unanimity of opinion. One point is the fact that animal experiments designed to test the matter have yielded divergent results. Another point is the fact that in reports of alleged injury to the embryo following a careful roentgen sterilization of the mother, the evidence shows that the cases really have no reference to the process of roentgen sterilization at a single sitting. Moreover, in such published cases important clinical and general factors were left out of consideration. In order that these reports may have any value, it is necessary to have: a minutely detailed account of the family history; most painstaking examination of the other children in the family and of the parents, grandparents; the social, living and working conditions must be carefully recorded; possible effects of lead, tobacco, alcoholism, syphilis, etc., must be sought. It is also of importance to state the locality in which the case occurred; and in what localities the offspring of roentgenized mothers have been brought up.